

## **Appendix A**

### **Traffic Analysis Information**

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Technical Memorandum  
No-Action Alternatives Analysis  
11400 South EIS

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September 2003

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Prepared by Wilson & Company  
Prepared for Utah Department of Transportation

## Introduction

The Wasatch Front Regional Council (WFRC) 2030 transportation demand model reflects the current long-range plan for the Wasatch Front planning area. The long-range plan includes an interchange at 11400 South, the connection of the 11400 South arterial across the Jordan River (700 West to 1300 West) and the widening of 11400 South from Redwood Road west to Bangerter.

The No-Action Alternatives in Phase One of the EIS process assume that the 11400 South interchange, the 11400 South arterial across the Jordan River (700 West to 1300 West) and widening of 11400 South from Redwood Road west to Bangerter, *are removed from the model*.

The No-Action Alternatives for the EIS included a combination of land use changes and transportation management (TM) strategies. There were four initial alternatives:

The No-Action alternatives to be developed in Phase One include:

1. No-Action Alternative 1: no interchange at 11400 South, no 11400 South arterial across the Jordan River (700 West to 1300 West), no widening of 11400 South from Redwood Road west to Bangerter and no land use adjustments to the model.
2. No-Action Alternative 2 with TM: same as Alternative 1, with the addition of Transportation Demand Management (TDM) and Transportation Systems Management (TSM) strategies for the project area.
3. No-Action Alternative 3 with Adjusted Land Use: same as Alternative 1, but with the land use adjusted to reflect the lack of an interchange at 11400 South.
4. No-Action Alternative 4 with Adjusted Land Use and TM: same as Alternative 2, but with the land use adjusted to reflect the lack of an interchange at 11400 South.

Potential 2030 land use changes were evaluated for No-Action Alternatives 3 and 4. Population and employment forecasts for the current 2030 model were reviewed for each project area traffic analysis zone (TAZ). After reviewing current land use maps gathered from Draper, Riverton, Sandy, and South Jordan it was determined that the developable TAZs in the corridor would not have substantial differences in development between a No-Action and Build alternative. It is likely that the absence of an interchange would slow the build out of undeveloped parcels, but not change the land use patterns of the model in any substantial way.

The remaining No-Action Alternatives for evaluation in this report are No-Action Alternative 1 and No-Action Alternative 2.

## I. Assumptions

The 2030 No-Action model provided by WFRC includes the following transportation system elements:

1. *No* interchange at 11400 South and I-15 and *no* bridge crossing of 11400 South over the Jordan River (700 West to 1300 West).

2. 11400 South is a two lane road west of State Street and west of 1300 West.
3. I-15 is widened in both directions to five lanes with HOV lanes south of 10600 South through the project area.
4. State Street is widened from four lanes to six lanes between 10600 South and 11400 South; State Street is widened from two lanes to four lanes between 11400 South and 12300 South.
5. Redwood Road is widened to 4 lanes through the project area.
6. An expansion of the light rail system through the project area from the Sandy City Civic Center to the south across 10600 South, 11400 South, and 700 East into Draper.
7. New commuter rail service along the railroad corridor west of I-15 through the project area from the north across 10600 South, Jordan Gateway, 11400 South, and 12300 South into Draper.
8. New bus service within the project area along Bangerter Highway, 10400/10600 South, 11400 South, and 12300/12600 South.
9. Increased bus service within the corridor, including high frequency routes along 10400/10600 South, 3700 West, Redwood Road, Lone Peak Parkway, Jordan Gateway, State Street, and 700 East.
10. New/additional bus park and ride lots along Redwood Road at 11100 South and 12300 South and at 10600 South and State Street. A new light rail park and ride is proposed for the area south of the project area near 1300 East and 12300 South.

Assumptions used in the operations analysis of the corridor include:

1. The I-15 northbound off ramp to 10600 South is modified to include a signalized intersection for a double right turn onto eastbound 10600 South.
2. Signals in the project area are coordinated east of Redwood Road and favor the predominant direction of travel – AM is towards I-15; PM is away from I-15 (volume dependent).
3. Major intersections use a 150-second cycle length. Signal phases and progression bands were optimized and adjusted for peak period travel conditions. Comparisons between the two No-Action alternatives assume similar phasing and progression bands; only minor adjustments to signal phasing and progression bands were made.
4. Pedestrian phases and transit stops were not considered at this level of analysis.

## II. Methodology

### ***A. Model Volumes and Post-Processing***

The WFRC 2030 travel demand model was utilized to forecast 2030 daily traffic volumes for the roadways within the study area for the No-Action alternatives. The model files (based on the long-range plan) contained enhancements for multi-modal/transit travel within the overall Salt Lake City area that included the 11400 South study area.

Existing daily traffic volumes were collected (existing reports and counts) to document existing conditions within the study area. The existing traffic volumes into and out of the study area were compared with projected 2030 traffic volumes into and out of the study area. An overall annual growth factor of approximately two percent for the study area was derived from this comparison of the 2030 model runs to the current daily traffic volumes. This growth factor was compared to the model link volumes and adjustments were made where necessary. The final growth rate was applied to the current average daily traffic volumes to develop 2030 daily traffic volumes for I-15 and the arterial street system.

### ***B. TM Development***

The AADT volumes for No-Action Alternative 2 (Transportation Management) were developed using assumptions about the level of transportation management that could be implemented. The reductions for the TM Alternative were limited by the amount of transit improvements already accounted for in the long-range plan, and consequently in the WFRC model. Additional reductions were applied as detailed in the technical report **No-Action Alternative with Transportation Management Applied, 11400 South EIS, August 25, 2003**.

The traffic reductions expected from the modeled TM measures in the Long Range Plan are accounted for in the No-Action model. Additional traffic reductions can be expected if Level 1 TM measures (and Supporting Actions) are implemented along with new or enhanced Level 2 TM measures. TM measures that are considered appropriate for the project area are shown below along with assumed AADT reductions.

Table 1 shows a TM measures list categorized as Level 1, Level 2, Level 3, and Supporting Actions. The second column indicates which TM Measures are accounted for in the 2030 model from WFRC. The third column indicates which TM measures can be added to enhance or increase the amount of traffic volume reduction in the model.

Although some TM measures in the Level 1 and Supporting Actions category may be assumed to already be in place for the model, the model won't necessarily account for the reduction, and are shown as additional TM measures in any case. Level 1 and Supporting Actions do not create substantial reductions by themselves, but are used to enhance the Level 2 and Level 3 TM measures.

Table 1 shows the assumption that TM measures may have a different reduction on the interstate versus the major arterials such as 10600 South, State Street, and 12300 South.

The Level 2 actions that are assumed to be added to the model include additional demand-responsive transit, a cross-town shuttle, free and reduced fare transit zones, additional HOV lanes and increased subsidies for the transit system. The demand-responsive transit system will not typically have a large impact on trip reduction and is more appropriate for non-work trips in the off-peak hours. Only a minor reduction can be expected for the major arterials. An intracity circulator system is assumed to serve only the major arterials and can be assumed to reduce trips more than demand-responsive transit. The cross-town circulators are assumed to serve the urbanized area in Sandy and Draper, particularly in the project area east of the Jordan River. Free and reduced fare transit zones may work in the project area, but are particularly suited for larger central business districts. This type of TM measure will have a minor effect only on the major arterials in the corridor east of the Jordan River. Without a full evaluation, additional HOV lanes could be considered on some arterials in the corridor and may include State Street and 10600 South. If HOV lanes could be implemented in the project corridor, the impact to the arterial system would be minor because the HOV incentive already exists on I-15. A similar argument could be made for special HOV treatment at the trip's endpoint with free, reduced, or preferential parking for HOVs. The impact is assumed to be minor because it can be considered as an enhancement to the existing HOV incentive.

Level 3 programs are aimed at drastically reducing traffic volumes and are much more restrictive. Consequently, the Level 3 TM measures face more political challenges and are more difficult to implement. The TM measures listed in Table 1 were considered and evaluated for the project area. Comments about each are shown in the last column of the table. The only Level 3 TM measure that was assumed to be appropriate for the project area is the restriction on land use. Large areas of the project area in the vicinity of 11400 South are undeveloped. These areas are planned for development as shown in city planning documents; however, it was assumed that land uses could be changed. Changes in land use may result in trip reductions up to four percent on the arterials and two percent on the interstate.

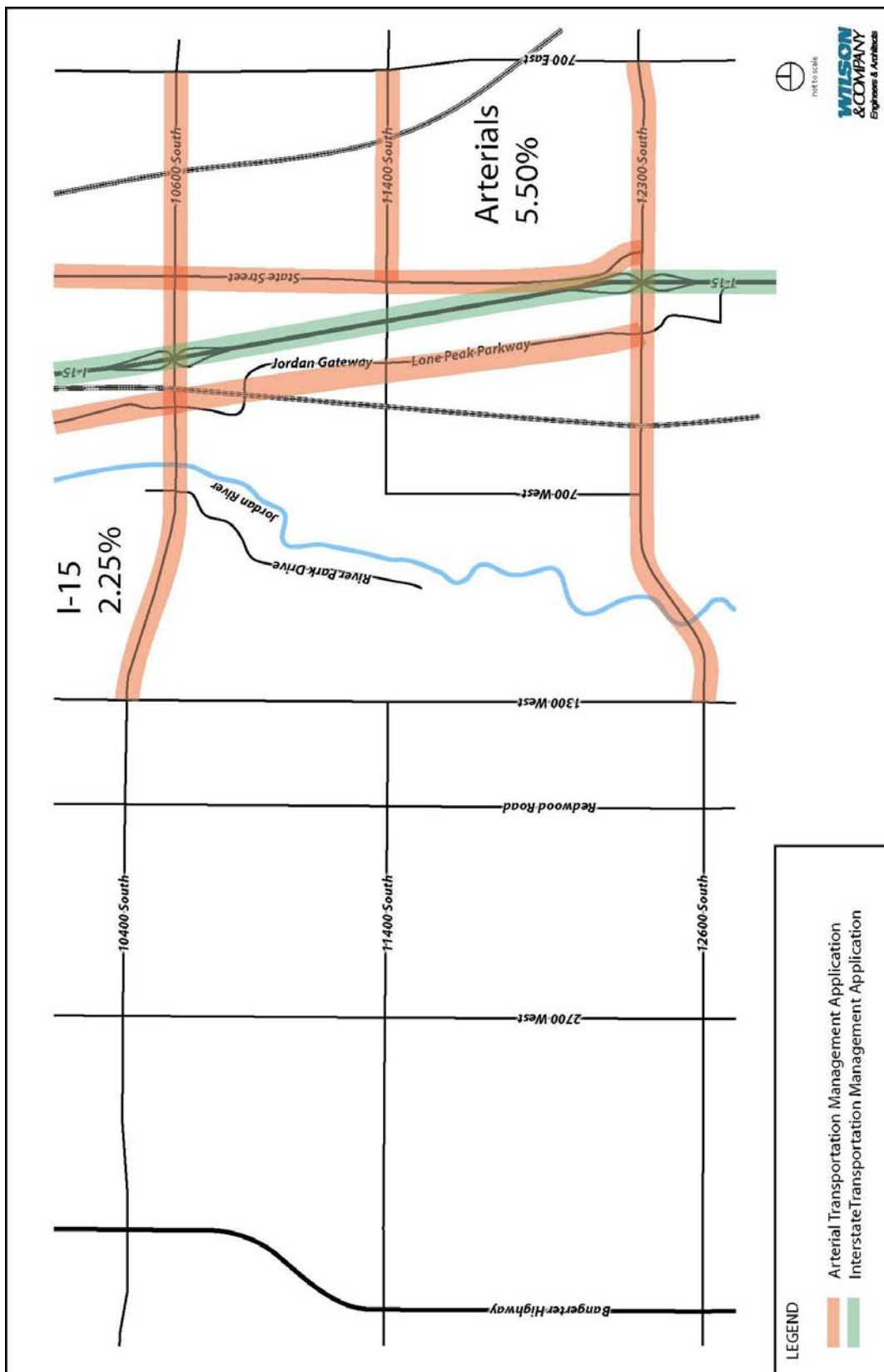
The last section of the table shows the Supporting Actions for the TM program described. The reductions for the supporting actions are assumed to be included in the Level 2 and Level 3 reductions above.

The reductions for each TM measure were assumed for each facility type – interstate and major arterial – based on the expected overall reductions for each level (i.e. Level 2, <5% reduction; Level 3, 5-10% reduction). The reductions were added together and applied to the AADT 2030 No-Action model volumes. Only corridors east of 1300 West, the major arterials and the interstate were assumed to be impacted by the TM measures. **See Figure 1.**

**Table 1. Transportation Management (TM) Program Development**

TM Measures	TM included in 2030 Model		Applied to		AADT % REDUCTION		Comments
		ADD	I-15	Maj Art	I-15	Maj Art	
Level 1: Starter level actions							
Transportation Coordinator		X	x	x	n/a	n/a	Starter Level actions are not intended to create large reductions.
Commute Information Center		X	x	x	n/a	n/a	Starter Level actions prepare the community for future actions.
Kiosks		X	x	x	n/a	n/a	
Trip planning		X	x	x	n/a	n/a	
Transit literature/website		X	x	x	n/a	n/a	
On-line route info		X	x	x	n/a	n/a	
Parking controls		X	x	x	n/a	n/a	
Targeted marketing		X	x	x	n/a	n/a	
Level 2: Programs designed to reduce traffic by 0-5 percent.							
Transit Expansion	X						
Demand Transit		X		x		0.25%	minor reduction, typically non-commuter
Increased Transit Service Headways	X						
Seamless Transit Service (comm rail, BRT)							
In-town Shuttle Service		X		x		0.50%	assumes intracity circulator.
Rail Transit	X						
Free or Reduced Transit Fares		X		x		0.25%	Free transit zones, minor reduction, works better in CBD areas.
Park & Ride Lots	X						
Jitneys							
HOV Lanes	X	X		x		0.25%	Exist I-15; add State N/o 10600; minor reduction in corridor (106,State)
Subsidies	X						
Preferential HOV Parking		X	x	x	0.25%	0.25%	minor reduction, HOV incentive already exists.
Intercept Remote Parking Lots							
Level 3: Programs designed to reduce traffic by 5-10 percent.							
Additional Subsidies							Politically prohibitive
Auto-Free Zones							Works best in remote areas; Requires heavy investment in satellite parking
Congestion Pricing							conversion to toll road; Politically prohibitive
Limited Capacity for SOVs							existing lane conversion to hot lanes, toll lanes; Politically prohibitive
Paid Parking							inappropriate in project area; more appropriate in CBD
Limited Parking Supply							inappropriate in project area; more appropriate in CBD
Licensing Fees or Quotas							Regional effort; Politically prohibitive
Gasoline Tax							Politically prohibitive
Annual Tax on Private Parking							inappropriate in project area; more appropriate in CBD
Land Use Restrictions		X	x	x	2.00%	4.00%	Ma y be politically prohibitive
Supporting Actions: TM measures that would help ensure the success of Level 1-3 programs.							
Guaranteed Ride Home Program	X						Reductions from supporting actions are included in Level 2 and Level 3 actions
Park & ride lots	X						
Telecommuting		X	x	x	n/a	n/a	
Real-Time Commuter Information		X	x	x	n/a	n/a	
Free or Discounted HOV Parking		X	x	x	n/a	n/a	
Employer options							
Flex-Time	X						
Compressed Work Week	X						
Travel Allowance (parking cash-out)		X	x	x	n/a	n/a	
Satellite office development		X	x	x	n/a	n/a	
Bicycle and Pedestrian Improvements	X						
Vanpool/Carpool Programs/Ridematching	X						
Bus stop shelters	X						
TOTAL AADT REDUCTION					2.25%	5.50%	

Figure 1. TM Reductions Applied within Project Area



### **C. Peak Hour Volumes**

The 2030 daily traffic forecasts were combined with peak hour characteristics measured in the field and peak traffic results from the WFRC travel demand model to yield peak hour forecasts within the study area. For roadways that are projected to be carrying traffic volumes at or exceeding the capacity of the facility, the peak hour percentages were refined along these facilities to reflect the capacity constraints. It is expected that, along these roadways, traffic levels during non-peak hours, when capacity does not constrain traffic flow, will see greater volume increases than during the peak hours resulting in a spreading of the peak period travel flows.

Areas where the peak hour percents were refined center around the I-15 interchanges at 10600 South and 12300 South and at nearby intersections. **Table 2** lists which intersections were modified from the original peak hour percents.

**Table 2. Intersections where the Peak Hour Percent has been changed for 2030 Growth**

<b>Location</b>	<b>Original Peak Hr %</b>	<b>No-Action Alternative 1 and Alternative 2 Peak Hr %</b>
WB 10600 at 1300W	4% (10%)	5% (9%)
WB 10600 at River Park	4% (10%)	5% (9%)
WB 10600 at Jordan Gtwy	7% (7%)	6% (7%)
EB 10600 at I-15	6% (8%)	6% (7%)
WB 10600 at I-15	9% (7%)	8% (7%)
SB I-15 at 10600	13% (10%)	10% (8%)
EB 10600 at State St	5% (8%)	5% (7%)
WB 10600 at State St	5% (8%)	5% (7%)
SB I-15 at 12300	13% (10%)	10% (8%)

### **D. Turning Movements**

The intersection peak hour turning movements were determined based on the existing travel patterns and the future peak hour link volumes. This procedure is generally described in the national Cooperative Highway Research Program Report 255 (NCHRP 255).

Specifically, to determine the 2030 turning movements, the 2030 peak hour inbound volumes at each intersection were multiplied by each existing turning movement percentage on the corresponding leg at each intersection in 2003. The results were the appropriate turning movements on each leg for 2030.

To balance the intersection volumes, the outbound volumes were calculated by adding the appropriate movements from each leg. The inbound and outbound volumes and turning percents were put into a NCHRP program to check the balance of the 2030 traffic volumes. After the iterative program finished, hand calculations were the final balance to each intersection.

The turning volumes from the final NCHRP balance were put into an existing map of the project area, as well as in Synchro for both morning and evening peak periods.

Throughout this process, some 2030 model annual average daily traffic (AADT) numbers and peak hour percents were revised, particularly around the I-15 interchanges. These modifications were evaluated and carried through using the process described above.

I-15 interchange and ramp data was evaluated similarly. The model data for AADT at these locations assumed a higher growth rate than what was projected. After modifying these model numbers, the interchanges were balanced using the NCHRP program.

Additional modifications of high-capacity road segments reduced the AADT, from spreading the peak hour to modifying the model volumes and each step was used to revise the numbers at these locations.

Alternative 2 improvements were also evaluated along the eastern portion of the project, along State Street, Lone Peak Parkway/Jordan Gateway, and around the I-15 interchanges at 10600 South and 12300 South. Because these improvements produced a lower AADT along some segments, these new AADT volumes were then evaluated using the aforementioned process.

Synchro<sup>1</sup> models were redefined and adjusted with the turning movements for AM and PM peak hours for No-Action Alternative 1 and No-Action Alternative 2. Within Synchro, the intersection splits and network offsets were optimized. The time-space diagram was adjusted so that a progression to and from the interstate could be coordinated for AM and PM peak hours, respectively.

After fine-tuning these Synchro files, the HCM<sup>2</sup> Arterial and Intersection Levels of Service (LOS) were recorded.

Using the Adobe Illustrator graphic from the initial conditions report, several pages of information were created. These include No-Action Alternatives 1 and 2, for both AM and PM:

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<sup>1</sup> SYNCHRO v5 (Build 323) (Windows 95/98/NT/2000), Copyright 1993-2001 by Trafficware.

<sup>2</sup> Highway Capacity Manual 2000, Transportation Research Board, National Research Council, National Academy of Sciences, 2000

- Updated 2030 AADT along each segment
- Updated peak hour percents at each intersection
- Incoming, balanced traffic volumes to each intersection
- Balanced turning movements at each intersection
- HCM Arterial and Intersection LOS for the project area
- Identified areas at or over capacity

### **III.No-Action Alternatives**

#### ***A. No-Action Alternative 1***

All 2030 graphics for No-Action Alternative 1 may be found in Appendix A.

The 2030 AADT for Alternative 1 is given as two-way, directional values. The 2030 AADT data shows how the traffic moves through the project area throughout the day. **See Figure A1.**

The peak hour percents for both AM and PM peak hours is similar to the peak hour percents for existing traffic; however, the peak hour does spread near the interchanges of 10600 South and I-15 and 12300 South and I-15. The intent is to show the amount of daily traffic that moves through the project area during the AM and PM peak hours. **See Figure A2.**

The inbound peak hour volumes, derived from the peak hour percents and the directional AADT volumes, gives an idea of the peak hour flow at each intersection. Inbound peak hour volumes show how traffic moves through the project area in the AM and PM peak hours. In the morning, the flow of traffic moves predominantly north and towards Interstate 15. In the evening, the traffic flow is southward and away from Interstate 15. **See Figure A3.**

The turning movements for both AM and PM peak hours show how the inbound volume on each leg is distributed. The turning movements show specifically how the traffic flows through intersections and give a closer look to the actual routes and movements that are utilized during the AM and PM peak hours. **See Figure A4.**

#### ***B. No-Action Alternative 2 – Transportation Management***

All 2030 graphics for No-Action Alternative 2 may be found in Appendix B.

The 2030 AADT for Alternative 2 is given as two-way, directional values. The 2030 AADT data shows how, with Transportation Management applied, the traffic moves through the project area throughout the day. Alternative 2 has a lower AADT around the interchanges than Alternative 1 due to the TSM adjustments. **See Figure B1.**

The peak hour percents for both AM and PM peak hours is similar to the peak hour percents for existing traffic and for Alternative 1; however, the peak hour is slightly different near the interchanges of 10600 South and I-15 and 12300 South and I-15. The peak hour percents show how the amount of daily traffic moves

through the project area in the AM and PM peak hours using TSM adjustments. **See Figure B2.**

The inbound peak hour volume is derived from the peak hour percent and the directional AADT volume, and gives an idea of the peak hour flow at each intersection. The inbound peak hour volumes show how traffic moves through the project area in the AM and PM peak hours utilizing the TSM adjustments. In the morning, the flow of traffic moves predominantly north and towards Interstate 15. In the evening, the traffic flow is southward and away from Interstate 15. **See Figure B3.**

The turning movements for both AM and PM peak hours show how the inbound volume on each leg is distributed. The turning movements show specifically how the traffic flows through intersections and gives a closer look to the actual routes and movements that are utilized during the AM and PM peak hours based on the TSM adjustments. **See Figure B4.**

## **IV. Operations Analysis**

### **A. All Day Capacity Analysis**

A general capacity analysis evaluates the capacity of the roadway segment based on the average annual daily traffic (AADT) along the facility. A reasonable planning estimate of all-day capacity for an *arterial* is 9750 vehicles per day per lane. This is based on a peak hour saturation flow capacity of 900 vehicles per hour per lane (vphpl), assuming a peak hour percentage of about nine percent and an average dedicated green time that is 50 percent of the total signal cycle.

For *freeway facilities* the typical all-day capacity is between 20,000 and 26,600 vehicles per lane, based on a peak hour saturation flow rate that can range from 1800 to 2400 vphpl. The analysis in this report uses 2200 vehicles per hour per lane, given that the facility is high-speed (65 mph versus 50 mph) and that the corridor is straight, flat, and wide. This is equivalent to an all-day capacity of 22,000 vehicles per lane per day. Currently, 2001 UDOT traffic data on I-15 south of Draper shows maximum flow rates between 2000 vphpl and 2200 vphpl.

The general capacity analysis provides a measure of the ability of the facility to handle traffic throughout the day and is a tool for evaluating the overall laneage capacity of the facility. In many cases, the general AADT capacity analysis may show that the facility will operate at capacity, while the peak hour analysis of the facility shows an operation below capacity. This is because the peak hour analysis is a better indicator of the intersection capacity on the facility. Congested intersections will meter traffic flow through the intersection and create a low flow condition on the arterial sections in between. See Appendix C for graphics of the All Day Capacity results.

### **B. Peak Hour Levels of Service**

The 2030 No-Action Alternatives peak hour levels of service for the key intersections in the project corridor are shown in Appendix C along with the

Existing Condition for comparison. The operations analysis of the project area was conducted using the Highway Capacity Software (HCS) 2000<sup>3</sup> methodology for interstate facilities and SYNCHRO<sup>4</sup> for the arterial system. Each program uses Highway Capacity Manual (HCM) 2000<sup>5</sup> methodology to calculate the level of service (LOS) for each individual intersection.

### **C. No-Action Alternative 1**

The following tables summarize the intersections that are at capacity (LOS E) or over capacity (LOS F) for the 2030 AM and PM peak hours for No-Action Alternative 1. A map of the intersection LOS may be found in Appendix D as Figure D1.

**Table 3. Intersections and Roadway Segments At- Or Over-Capacity for the 2030 AM Peak Hour**

LOCATION	INTERSECTION LOS
<b>10400 South / 10600 South</b>	
10400 South & Redwood Road	E
10400 South & 1300 West	F
<b>12300 South / 12600 South</b>	
12600 South & Bangerter Highway	F
12300 South & Lone Peak Parkway	F
12300 South & State Street	F

**Table 4. Intersections and Roadway Segments At- Or Over-Capacity for the 2030 PM Peak Hour**

LOCATION	INTERSECTION LOS
<b>10400 South / 10600 South</b>	
10400 South & Redwood Road	E
10400 South & 1300 West	F
10600 South & Jordan Gateway	F
10600 South & State Street	F
<b>11400 South</b>	
11400 South & State	F
11400 South & 2700 West	E
<b>12300 South / 12600 South</b>	
12600 South & Redwood Road	E

<sup>3</sup> Highway Capacity Software 2000 v4.1b (Windows 95/98/NT/2000), developed by the McTrans Center at the University of Florida, Highway Capacity Manual Copyright 2000 by the Transportation Research Board (TRB).

<sup>4</sup> SYNCHRO v5 (Build 323) (Windows 95/98/NT/2000), Copyright 1993-2001 by Trafficware.

<sup>5</sup> Highway Capacity Manual 2000, Transportation Research Board, National Research Council, National Academy of Sciences, 2000

### ***D. No-Action Alternative 2 – Transportation Management***

The following tables summarize the intersections that are at capacity (LOS E) or over capacity (LOS F) for the 2030 AM and PM peak hours for No-Action Alternative 2. A map with all intersection LOS for Alternative 2 may be found in Appendix D as Figure D2.

**Table 5. Intersections and Roadway Segments At- Or Over-Capacity for the 2030 AM Peak Hour**

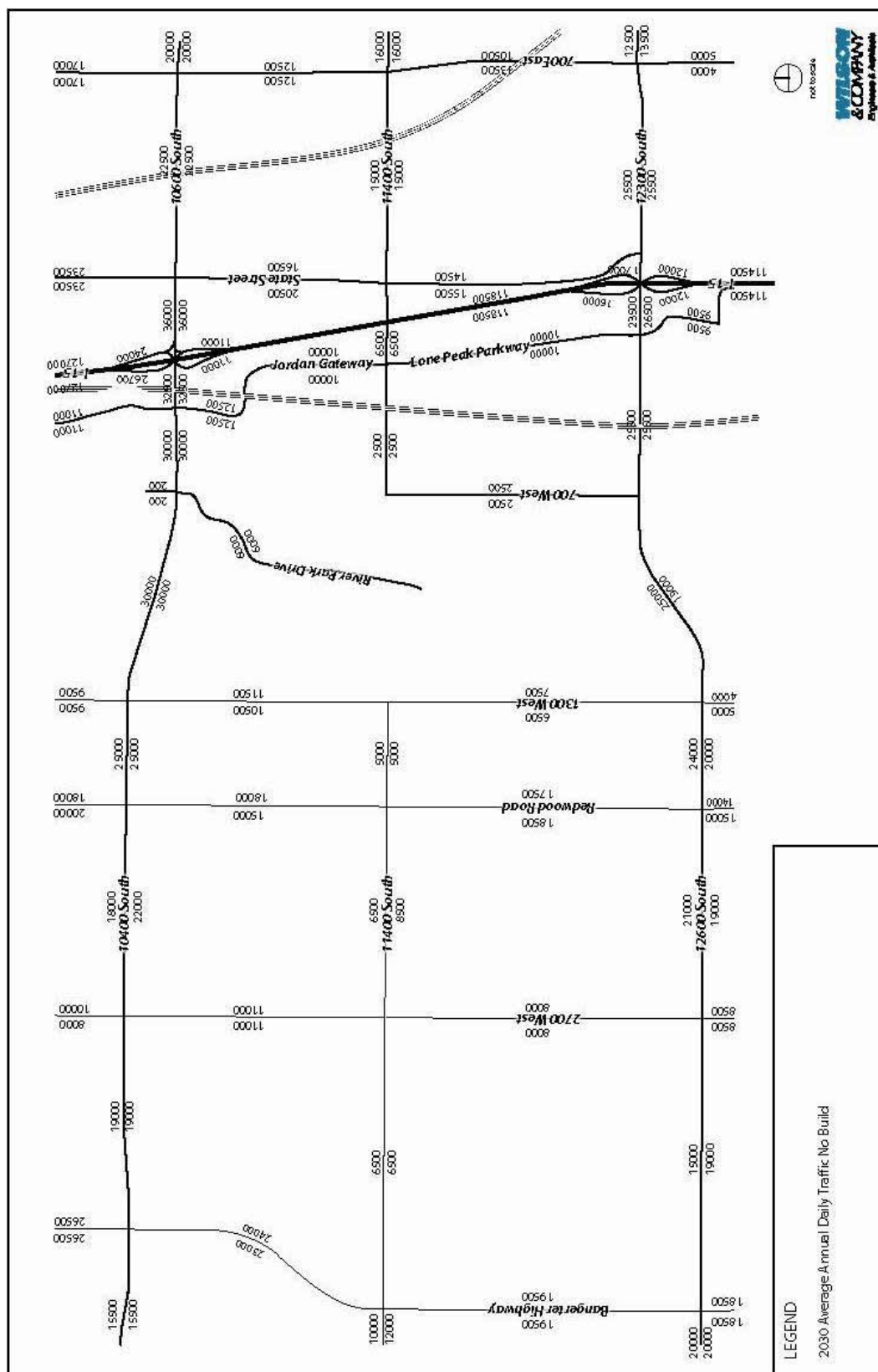
LOCATION	INTERSECTION LOS
<b>10400 South / 10600 South</b>	
10400 South & Redwood Road	E
10400 South & 1300 West	F
<b>12300 South / 12600 South</b>	
12600 South & Bangerter Highway	F
12300 South & Lone Peak Parkway	E
12300 South & State Street	E

**Table 6. Intersections and Roadway Segments At- Or Over-Capacity for the 2030 PM Peak Hour**

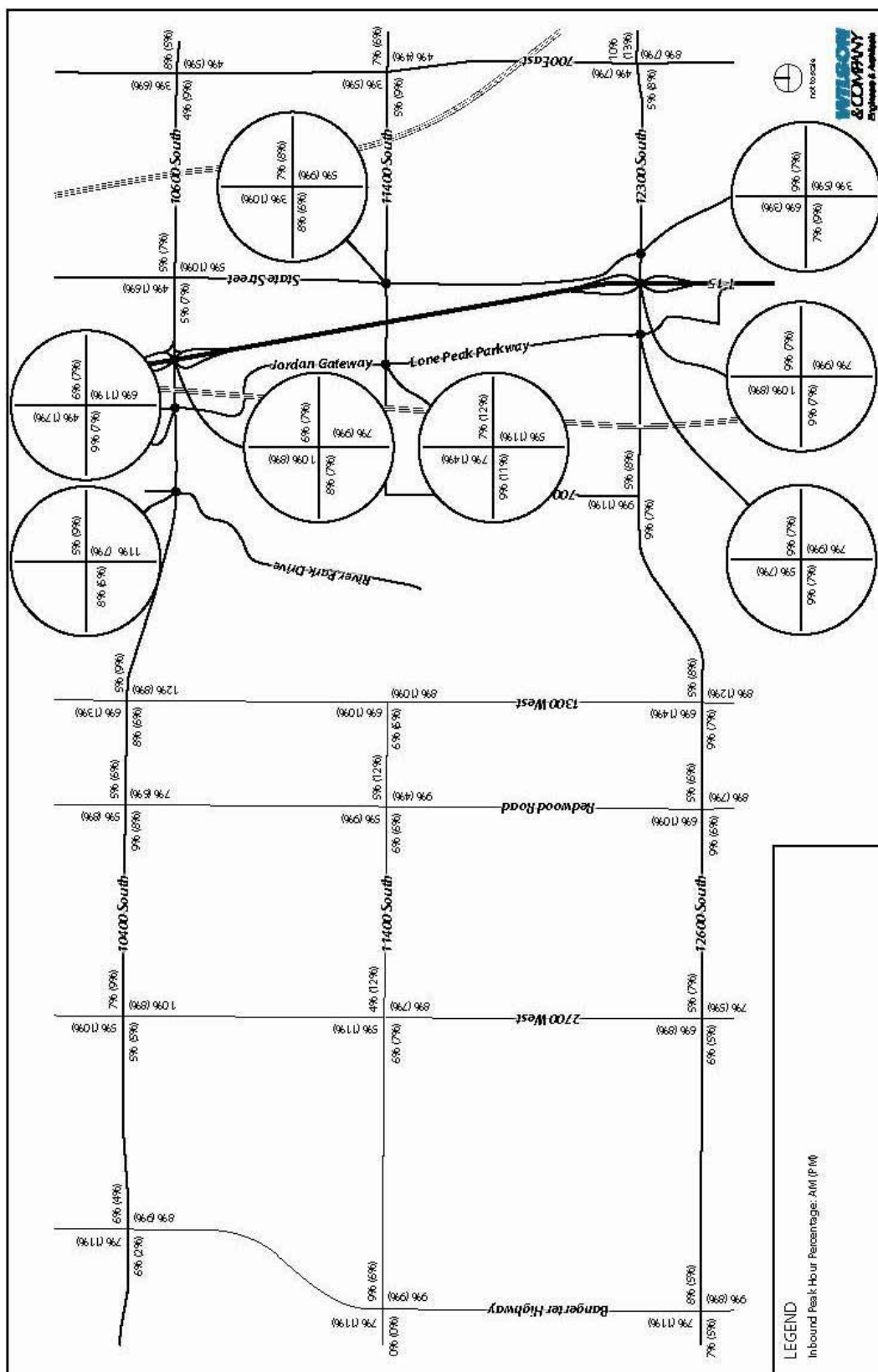
LOCATION	INTERSECTION LOS
<b>10400 South / 10600 South</b>	
10400 South & Redwood Road	E
10400 South & 1300 West	F
10600 South & Jordan Gateway	F
10600 South & State Street	F
<b>11400 South</b>	
11400 South & State	E
11400 South & 2700 West	E
<b>12300 South / 12600 South</b>	
12600 South & Redwood Road	E

## Appendix A

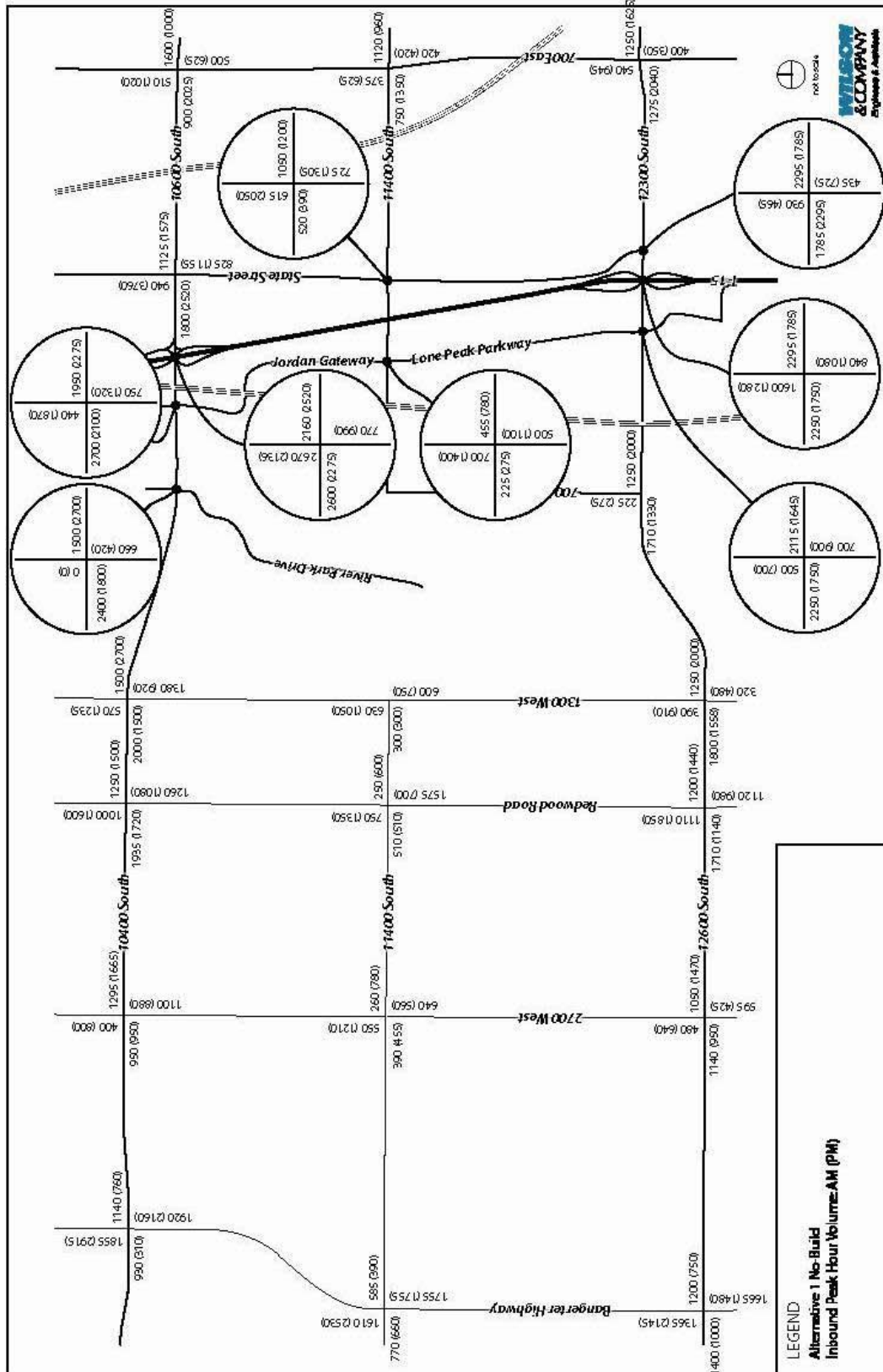
## A.1 2030 Alternative 1 AADT



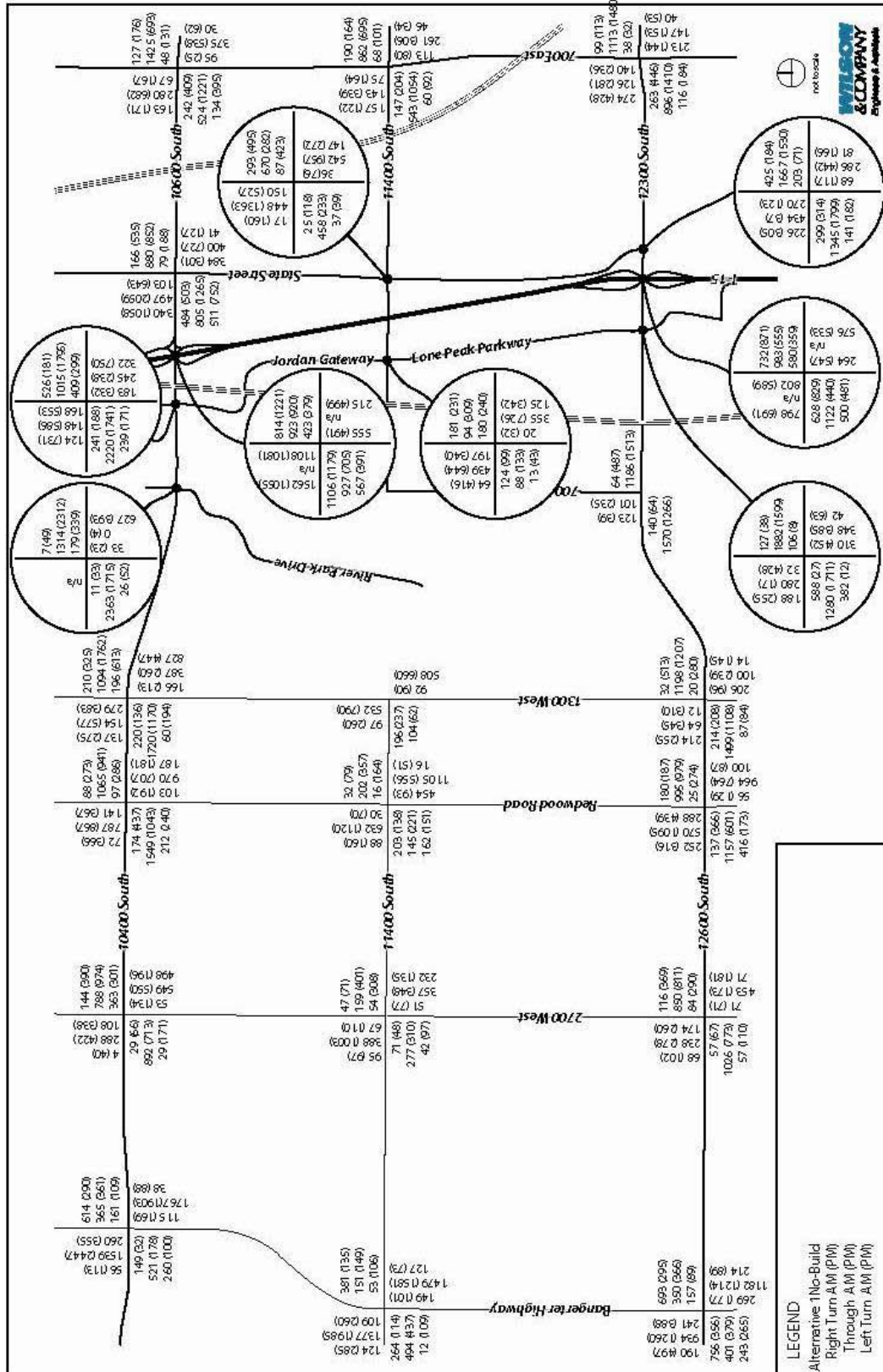
## A2. 2030 Alternative 1 Peak Hour Percents



### A3. 2030 Alternative 1 Inbound Peak Hour Volumes

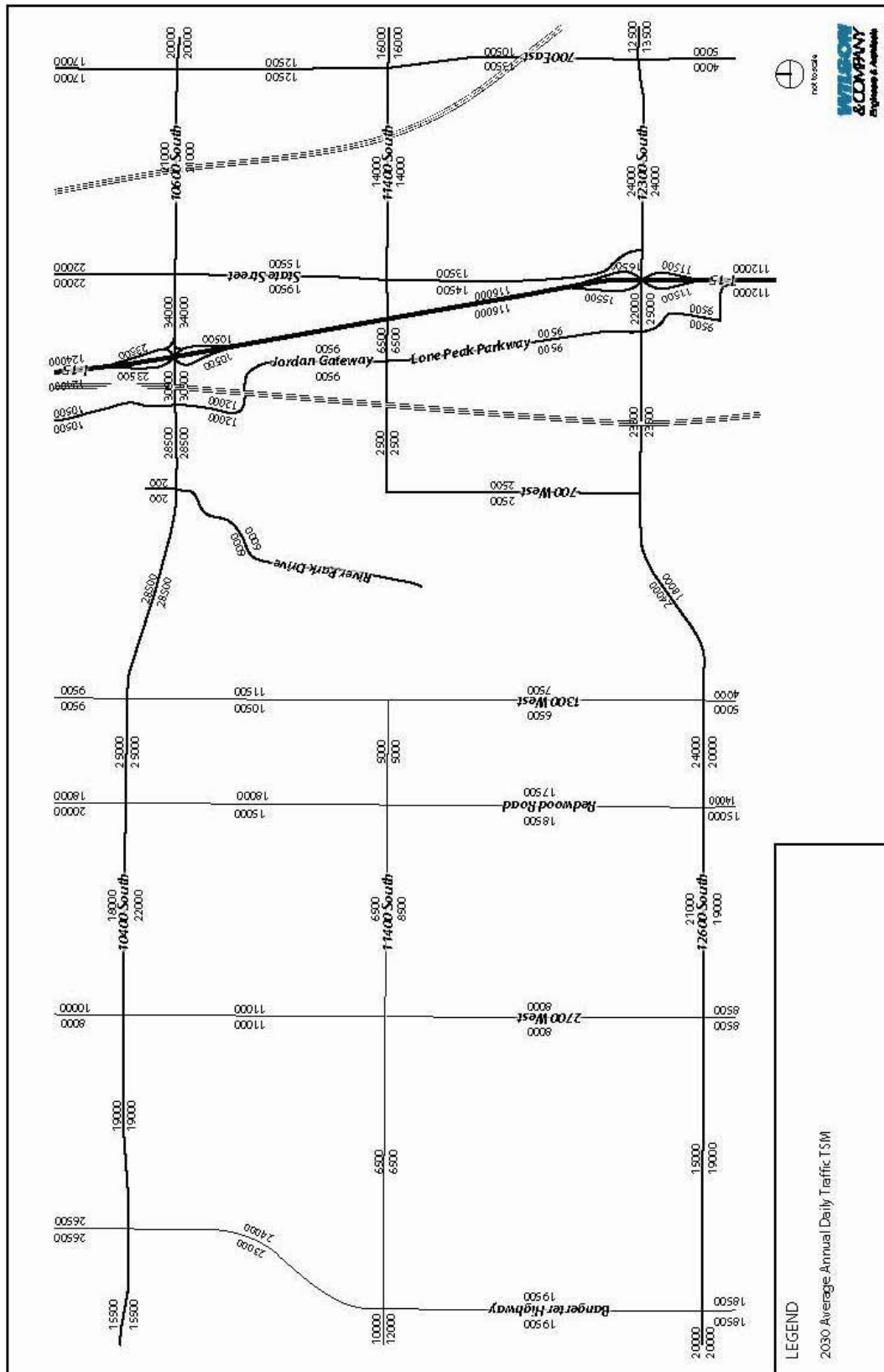


# A4. 2030 Alternative 1 Peak Hour Turning Movements

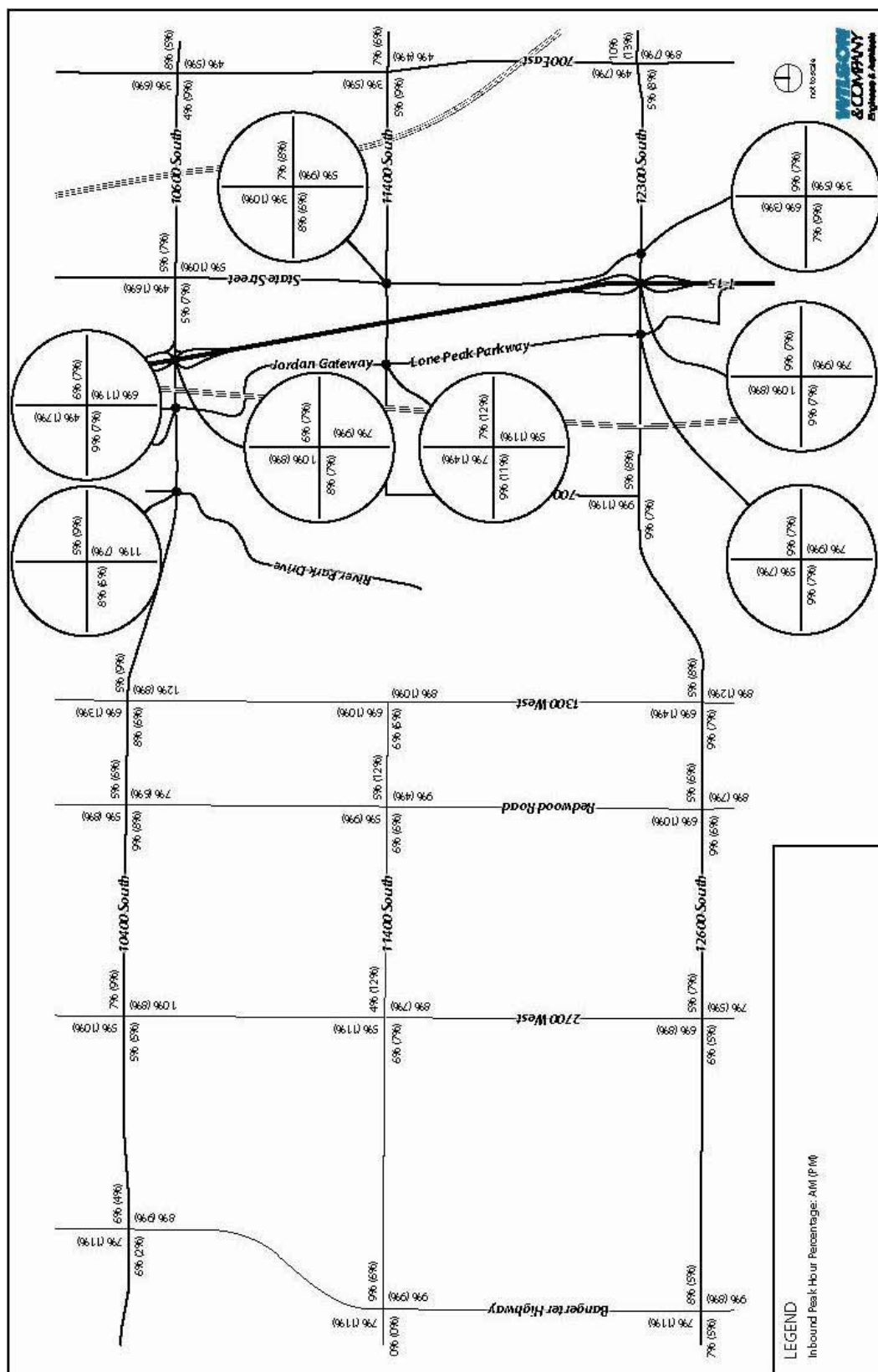


## Appendix B

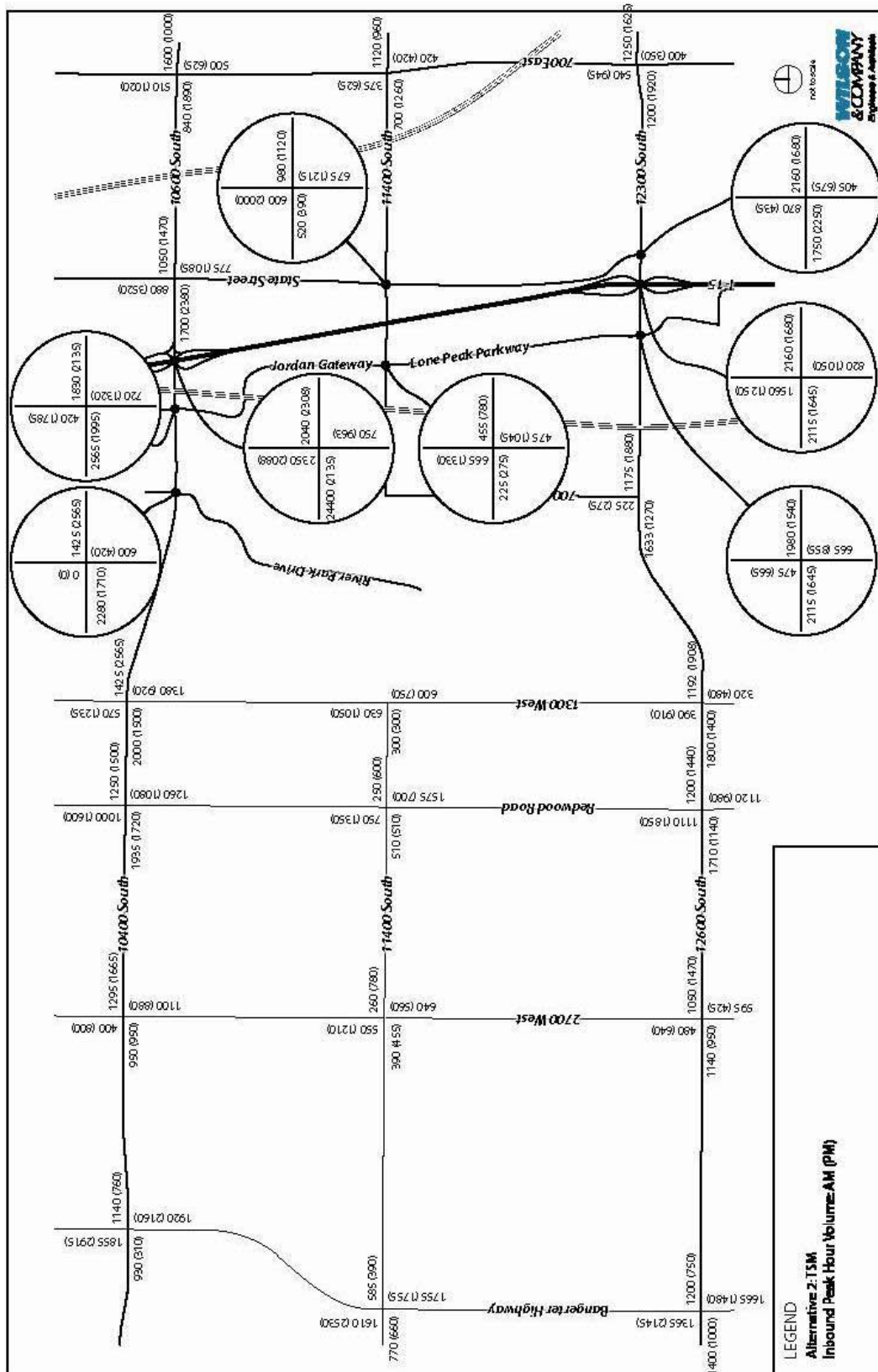
# B1. 2030 Alternative 2 AADT



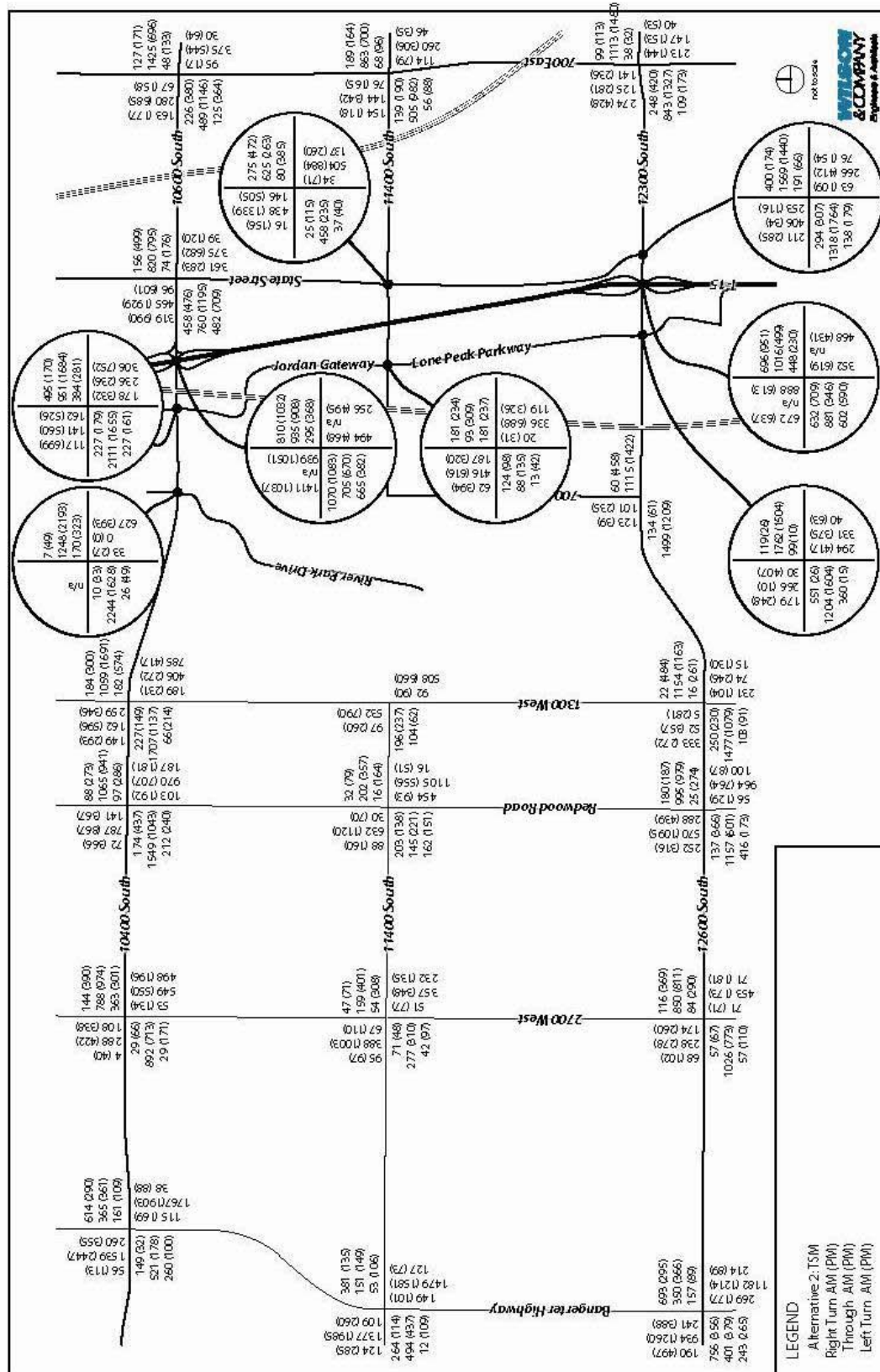
## B2. 2030 Alternative 2 Peak Hour Percents



### B3. 2030 Alternative 2 Inbound Peak Hour Volumes

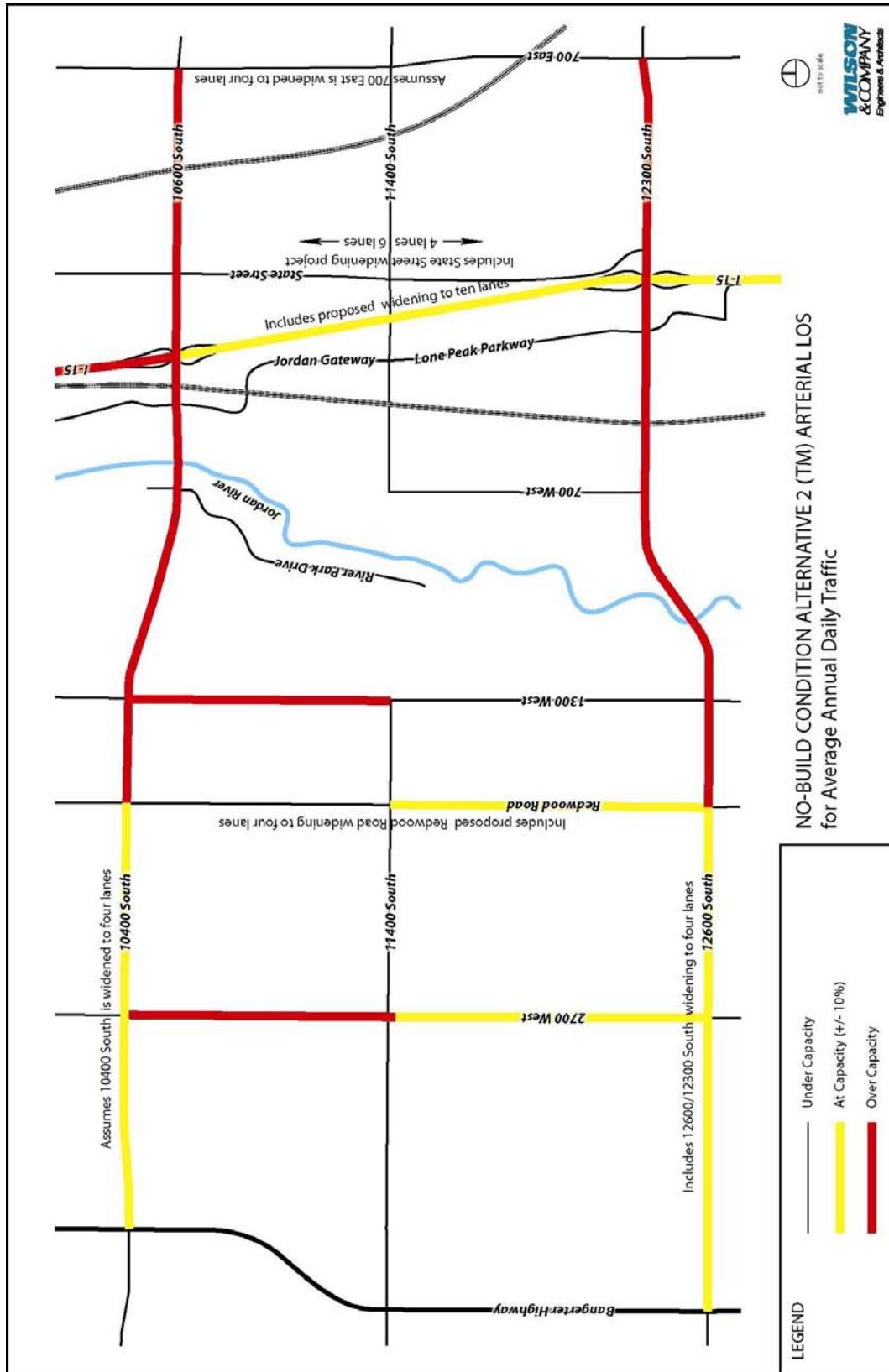


## B4. Alternative 2 Peak Hour Turning Movements

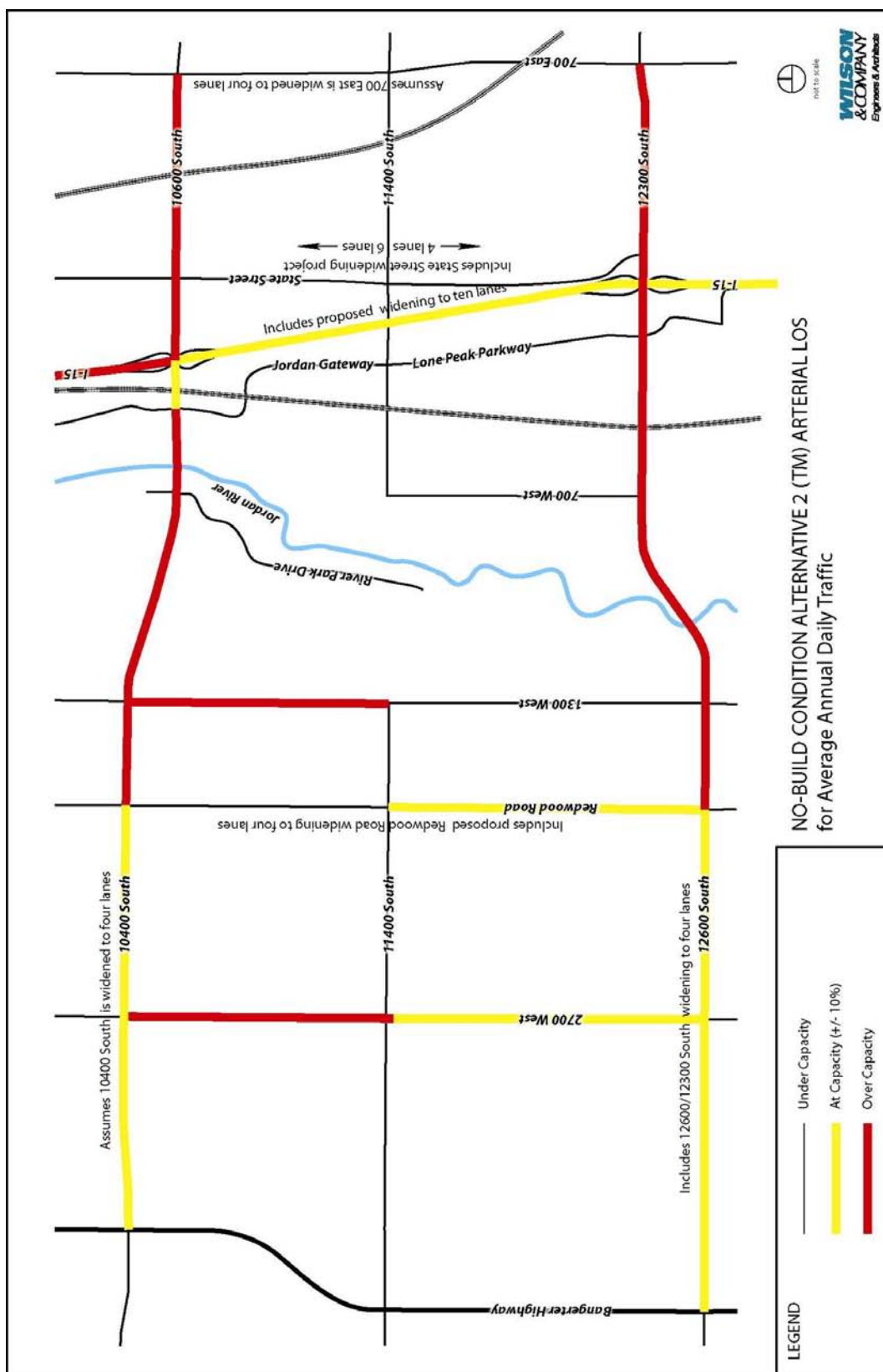


## Appendix C

# C1. All Day Capacity Analysis for Alternative 1

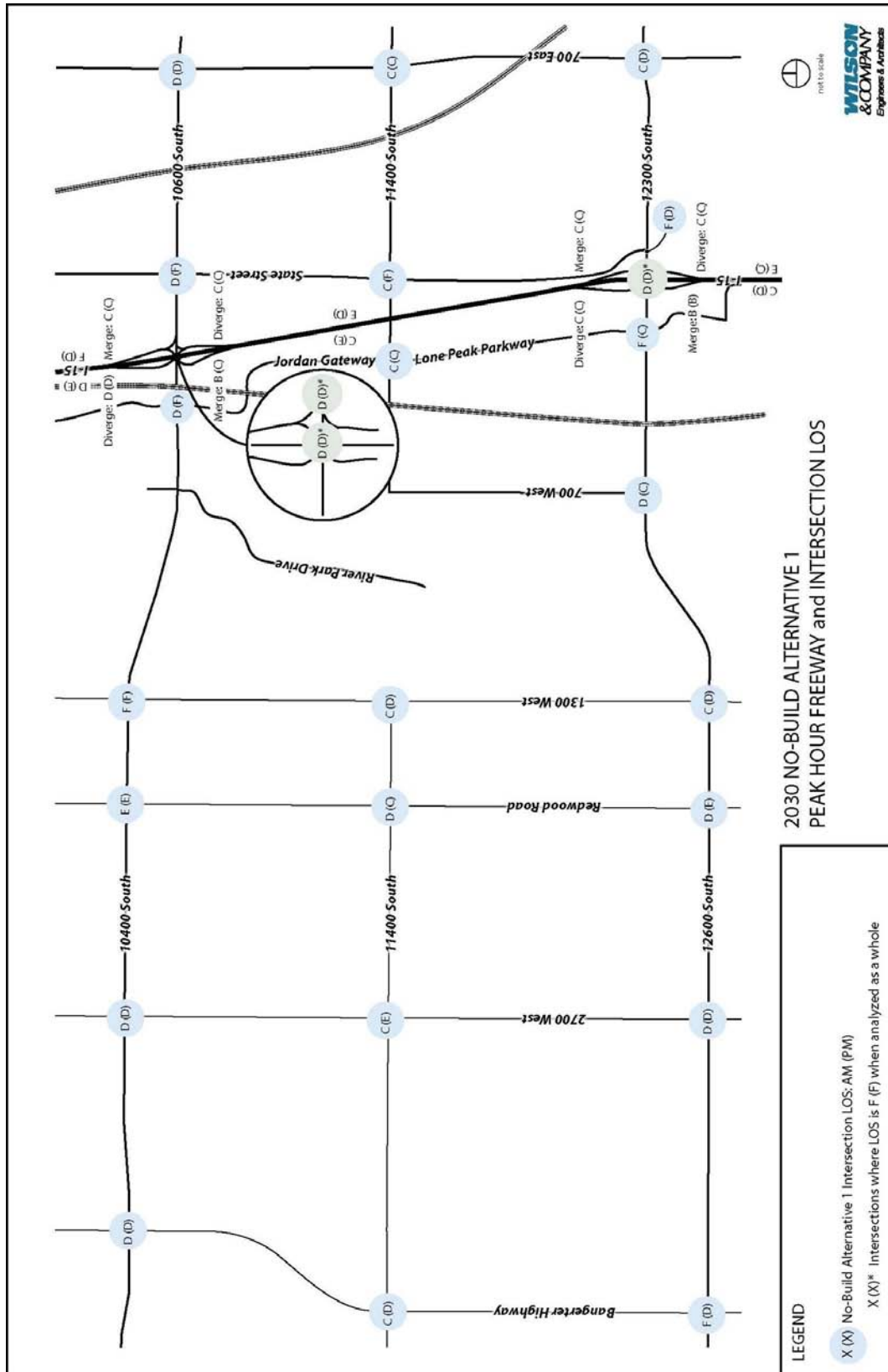


## C2. All Day Capacity Analysis for Alternative 2

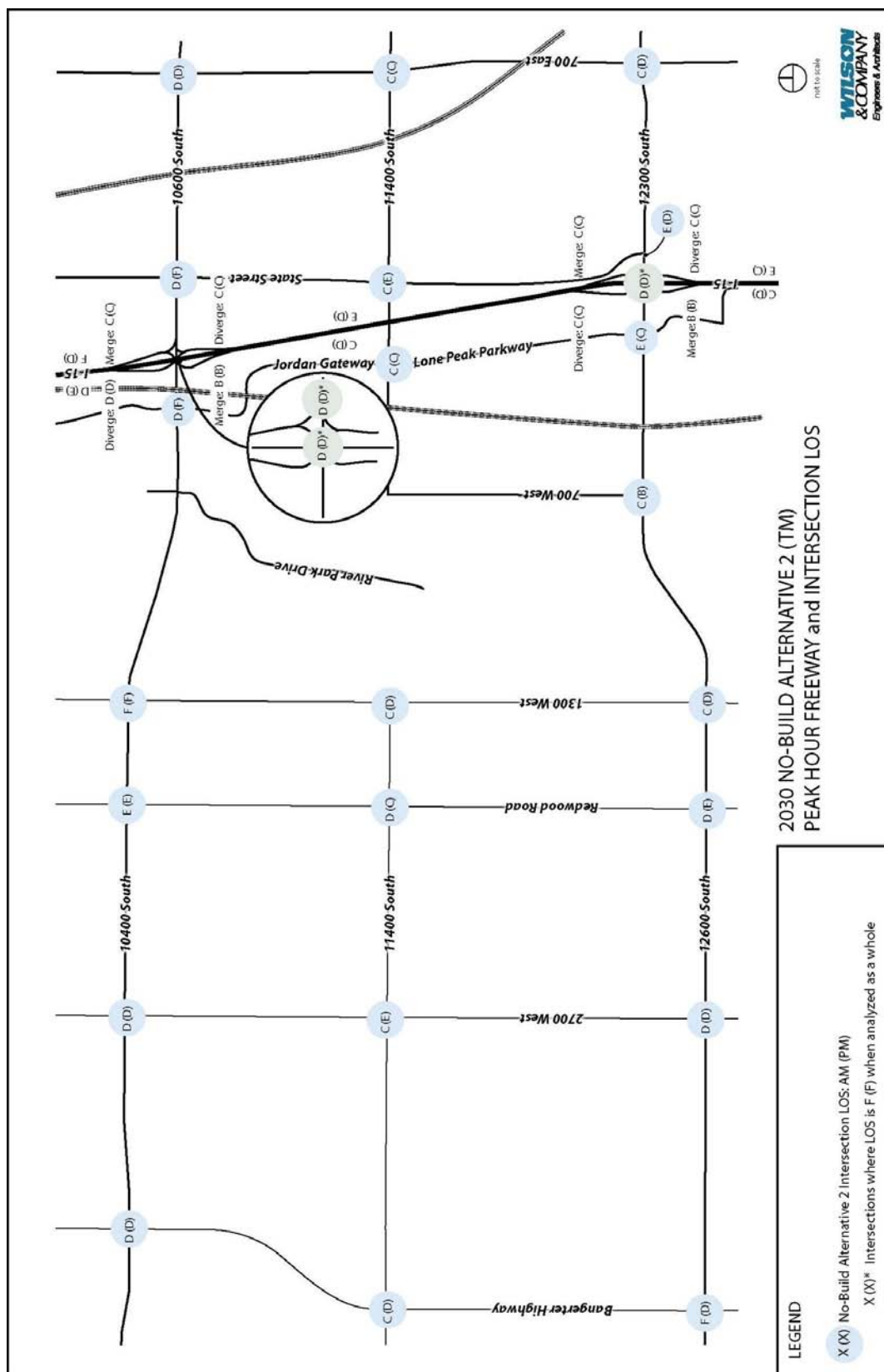


## Appendix D

## D1. 2030 Alternative 1 Intersection LOS



## D2. 2030 Alternative 2 Intersection LOS



Technical Memorandum  
AM Peak Hour Data Development  
11400 South EIS

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May 2004

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Prepared by Wilson & Company  
Prepared for Utah Department of Transportation

## I. Development of AM Peak Hour Percentages and Volumes<sup>1</sup>

Morning peak hour volumes were based on existing peak hour percentages and peak hour percentages derived from the model. These peak hour percentages were applied to the network volumes generated as detailed in the **Technical Memorandum – Initial Screening Model Development** to set AM peak hour inbound and outbound intersection volumes for the 28 major intersections and interstate ramp terminals in the project area.

Final AM peak hour percentages and volumes for each intersection and alternative are shown in the Appendix, **Figures 1 through 8**.

## II. Development of AM Turning Movements

Morning peak hour turning movements were based on existing peak hour turning movement percentages and the turning movement percentages from the No-Action model. These turning movement percentages were generated for each intersection and applied to each alternative in the project area to set AM peak hour turning movement volumes for the 28 major intersections and interstate ramp terminals in the project area.

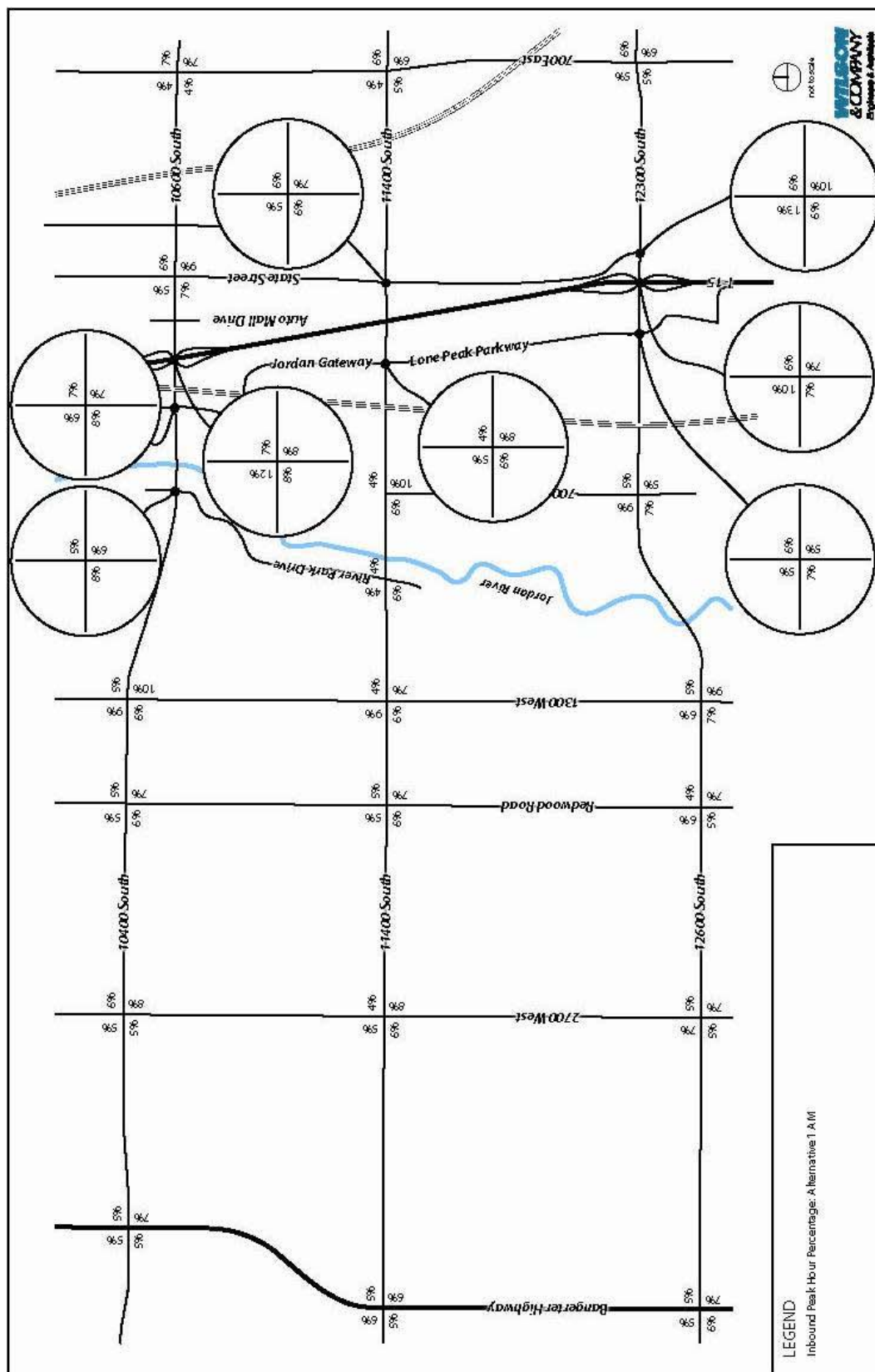
Final AM peak hour turning movements for each intersection and alternative are shown in the Appendix, **Figures 9 through 12**.

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<sup>1</sup> AM volumes were developed only for Alternatives carried over from the first screening analysis.

## Appendix

Figure 1. Alternative 1 AM Peak Hour Percentages



**Figure 2. Alternative 3(a) AM Peak Hour Percentages**

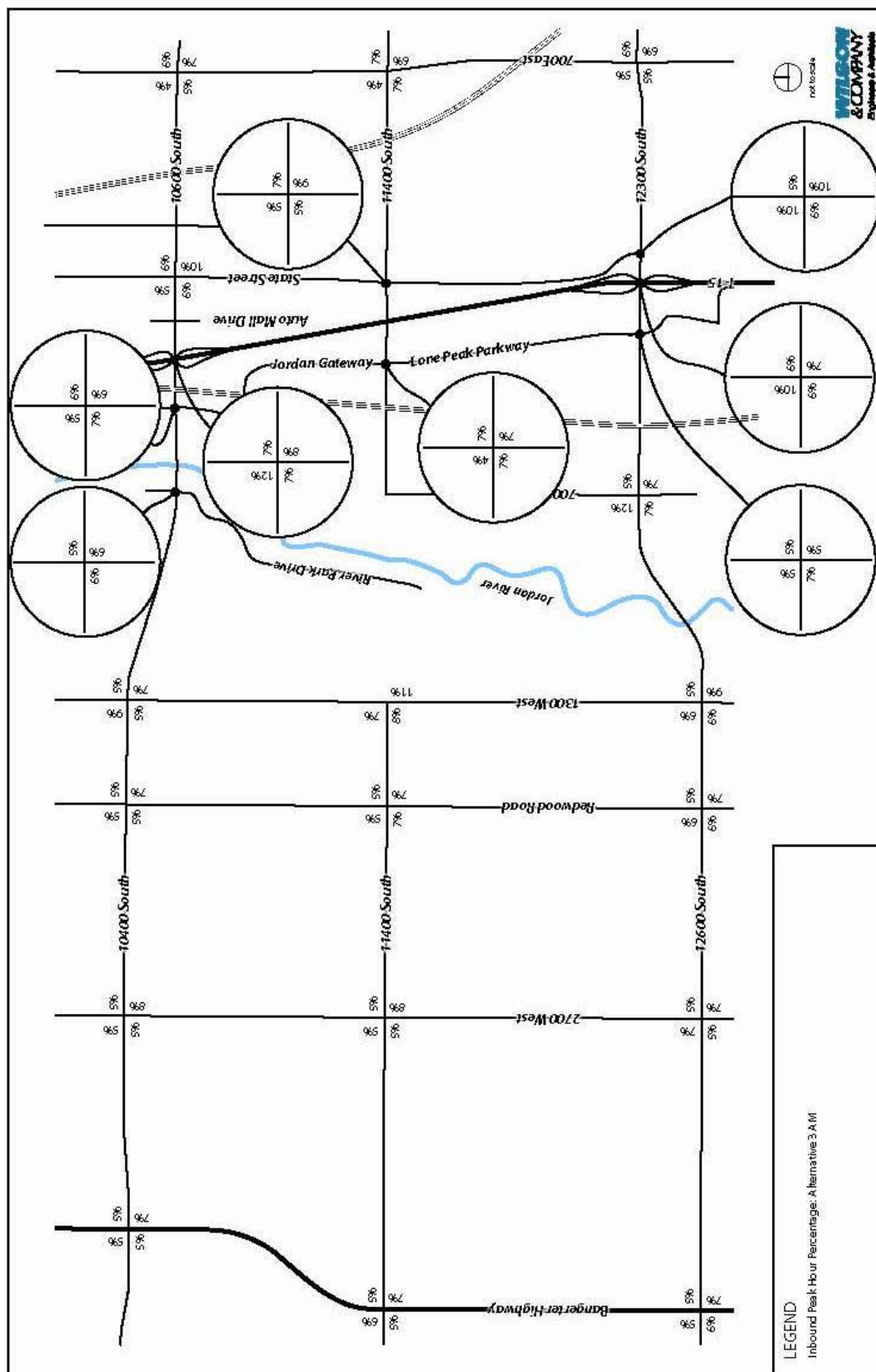


Figure 3. Alternative 4 AM Peak Hour Percentages

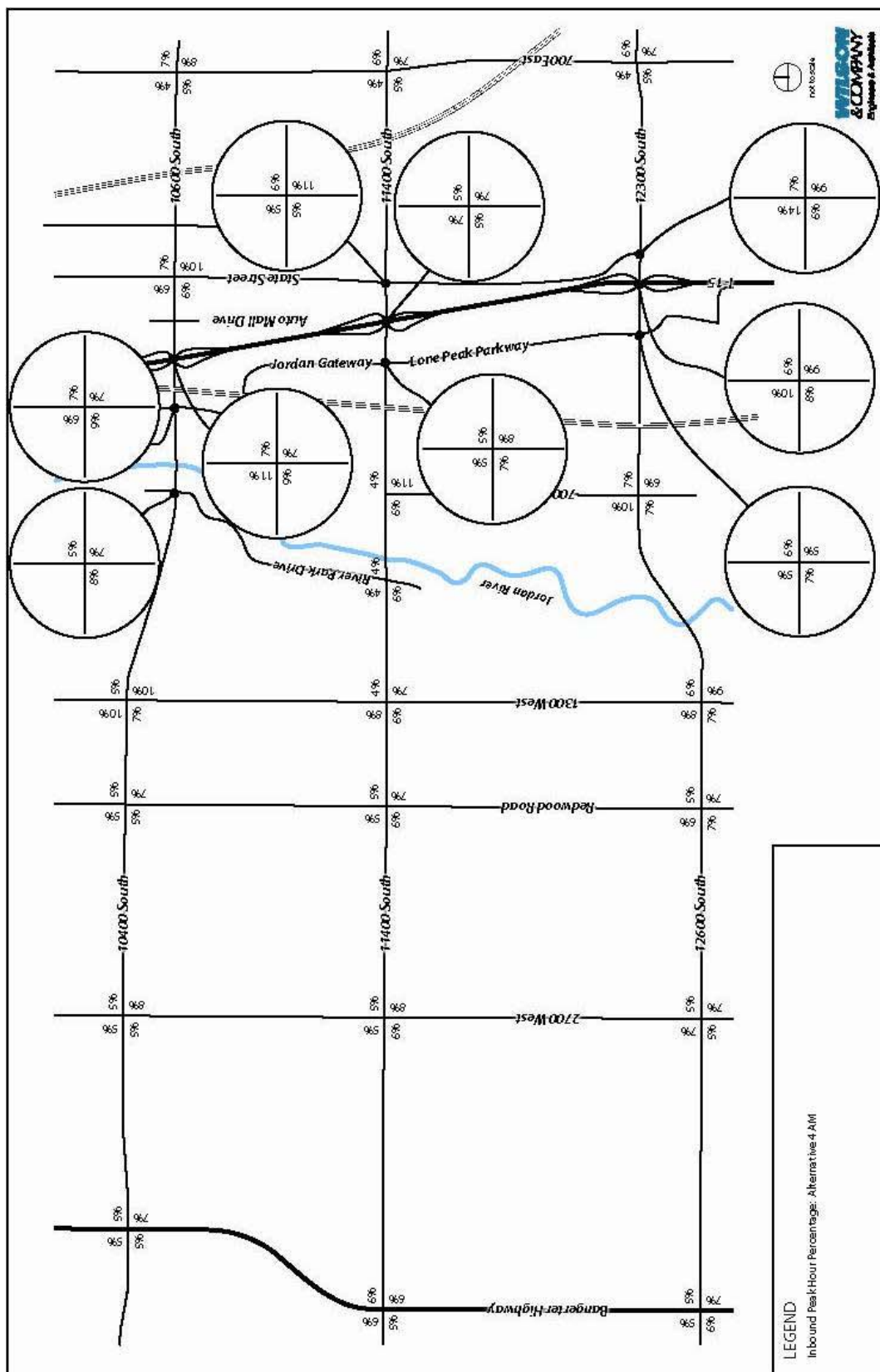


Figure 4. Alternative 7 AM Peak Hour Percentages

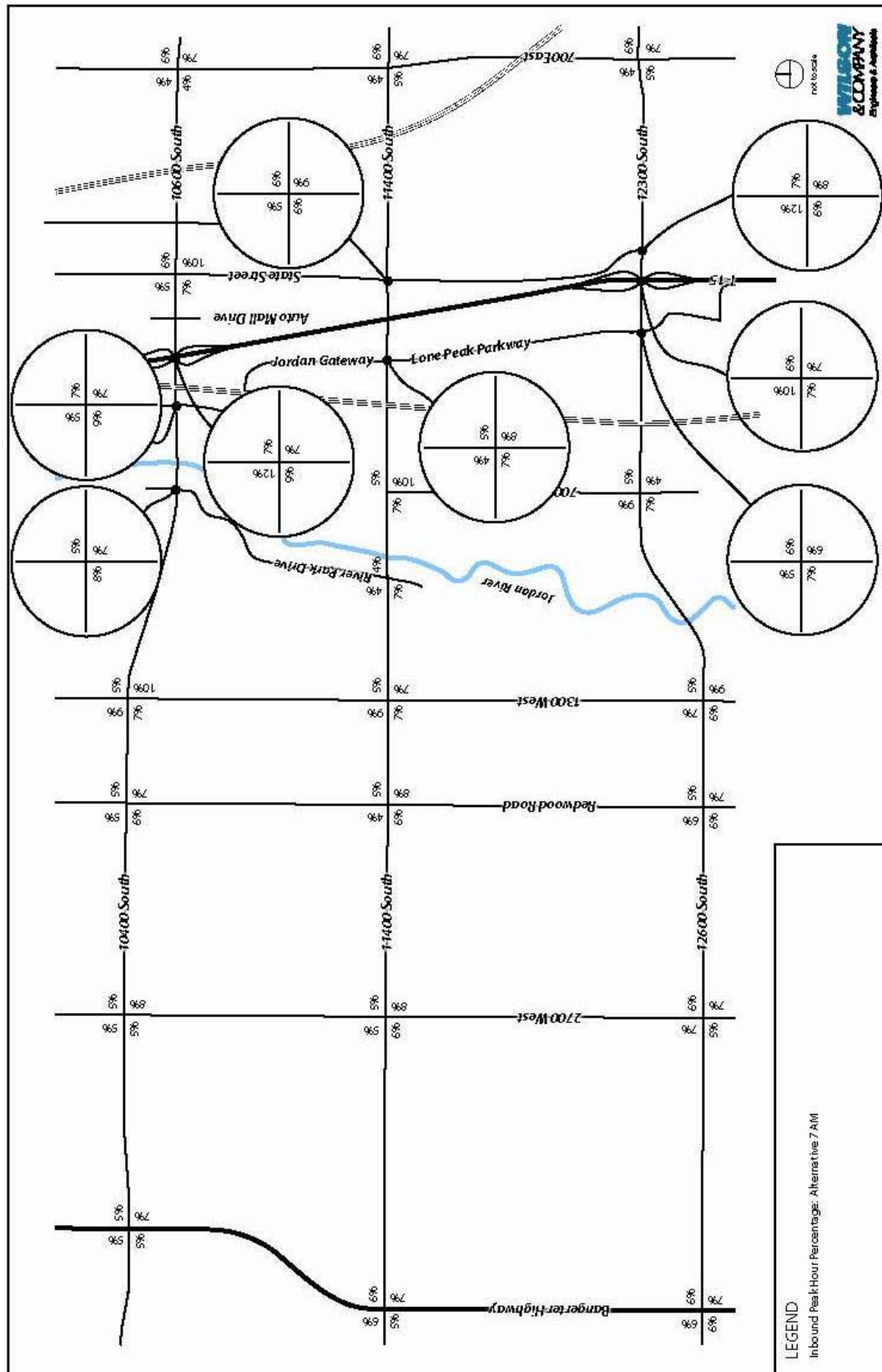
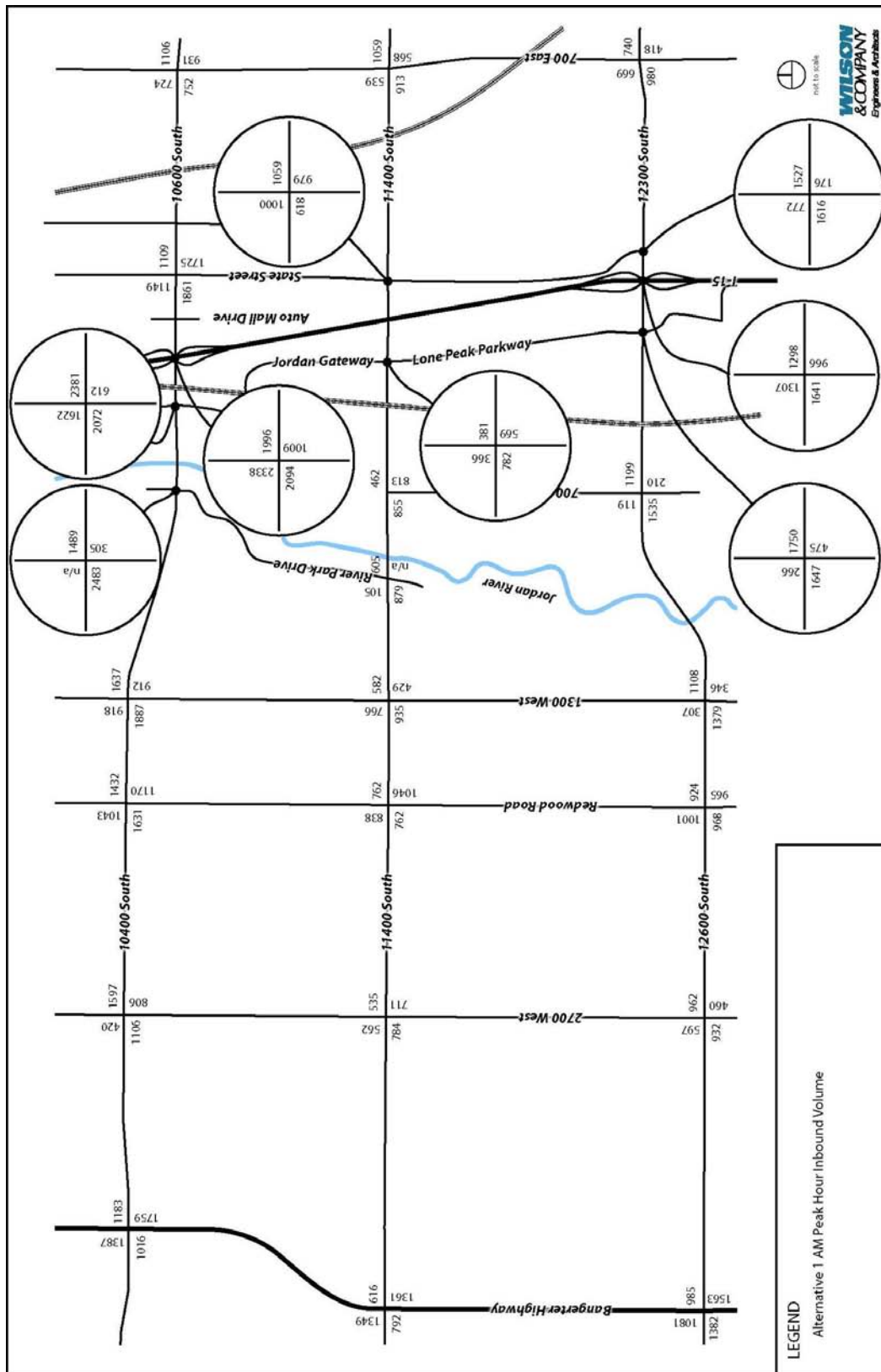


Figure 5. Alternative 1 AM Peak Hour Inbound Volumes



**Figure 6. Alternative 3(a) AM Peak Hour Inbound Volumes**

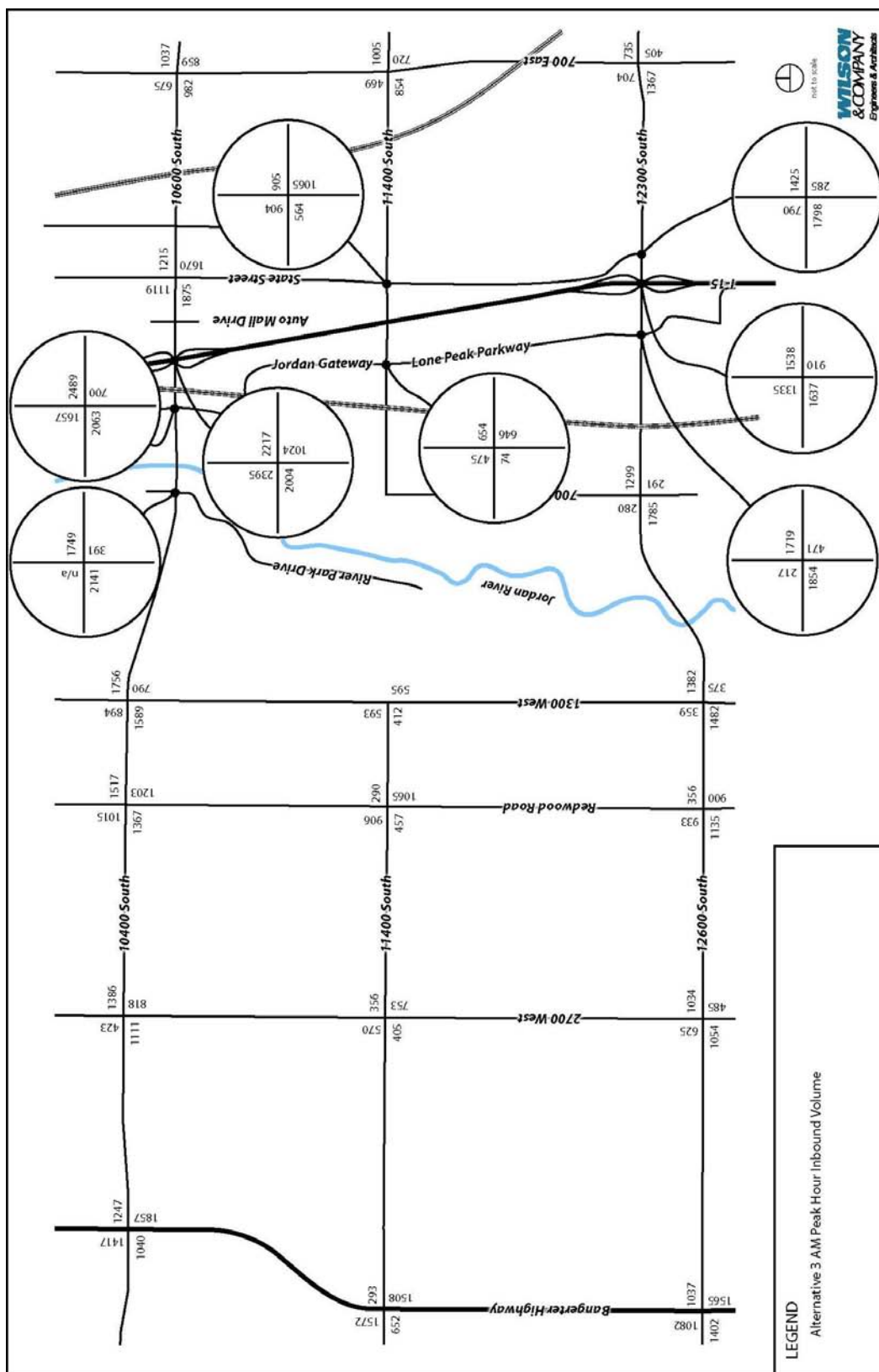


Figure 7. Alternative 4 AM Peak Hour Inbound Volumes

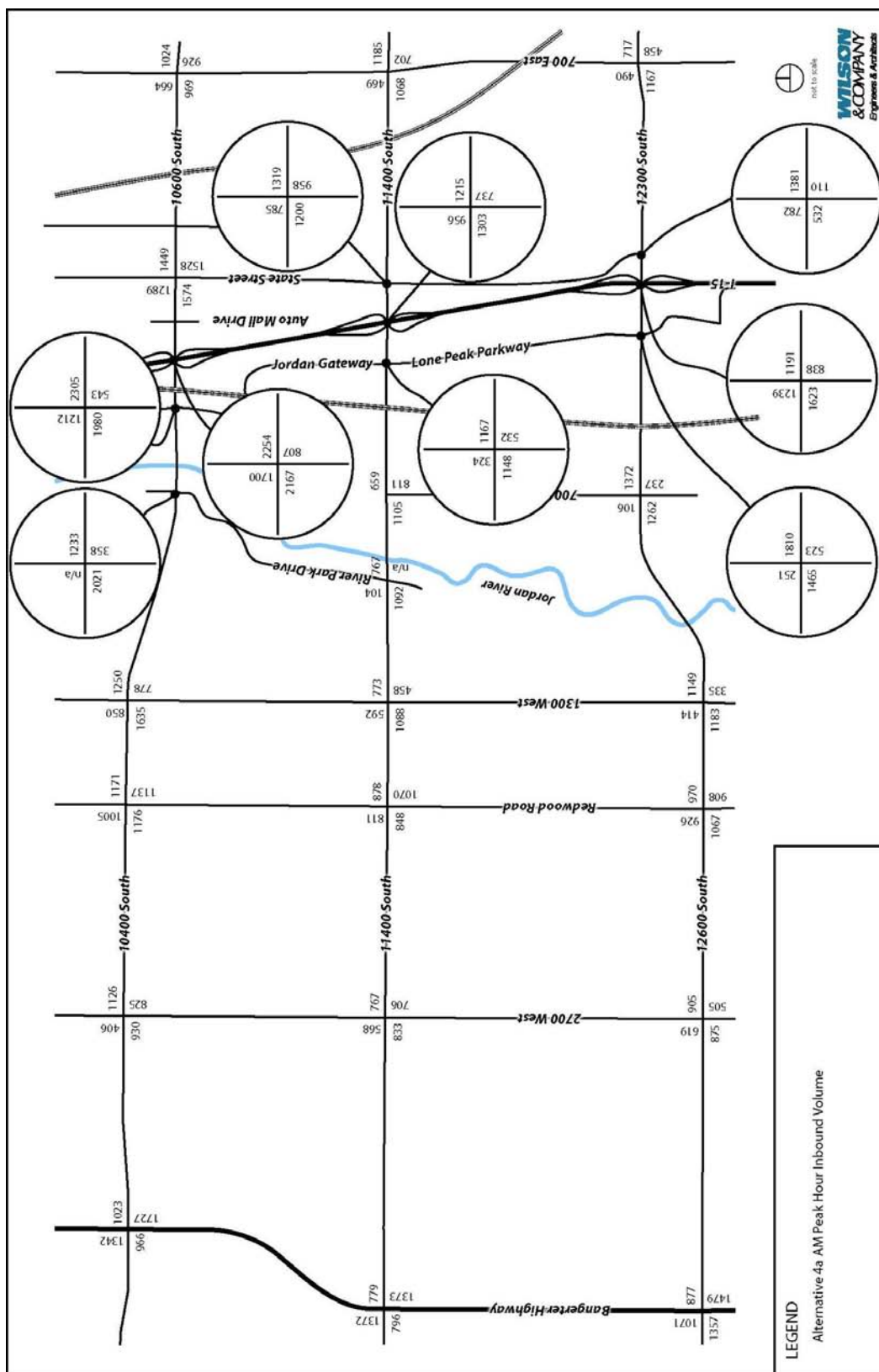


Figure 8. Alternative 7 AM Peak Hour Inbound Volumes

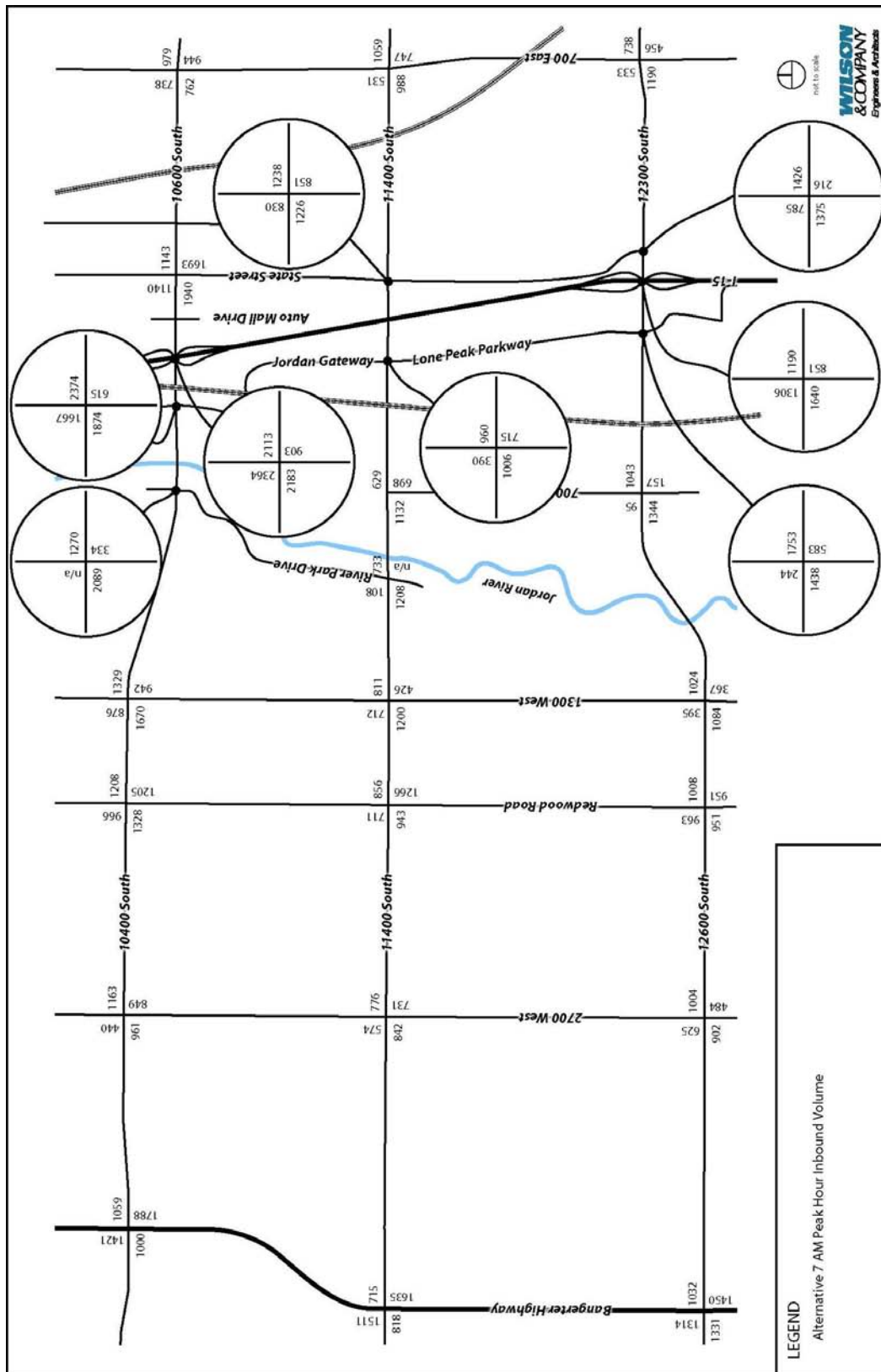


Figure 9. Alternative 1 AM Peak Hour Turning Movements

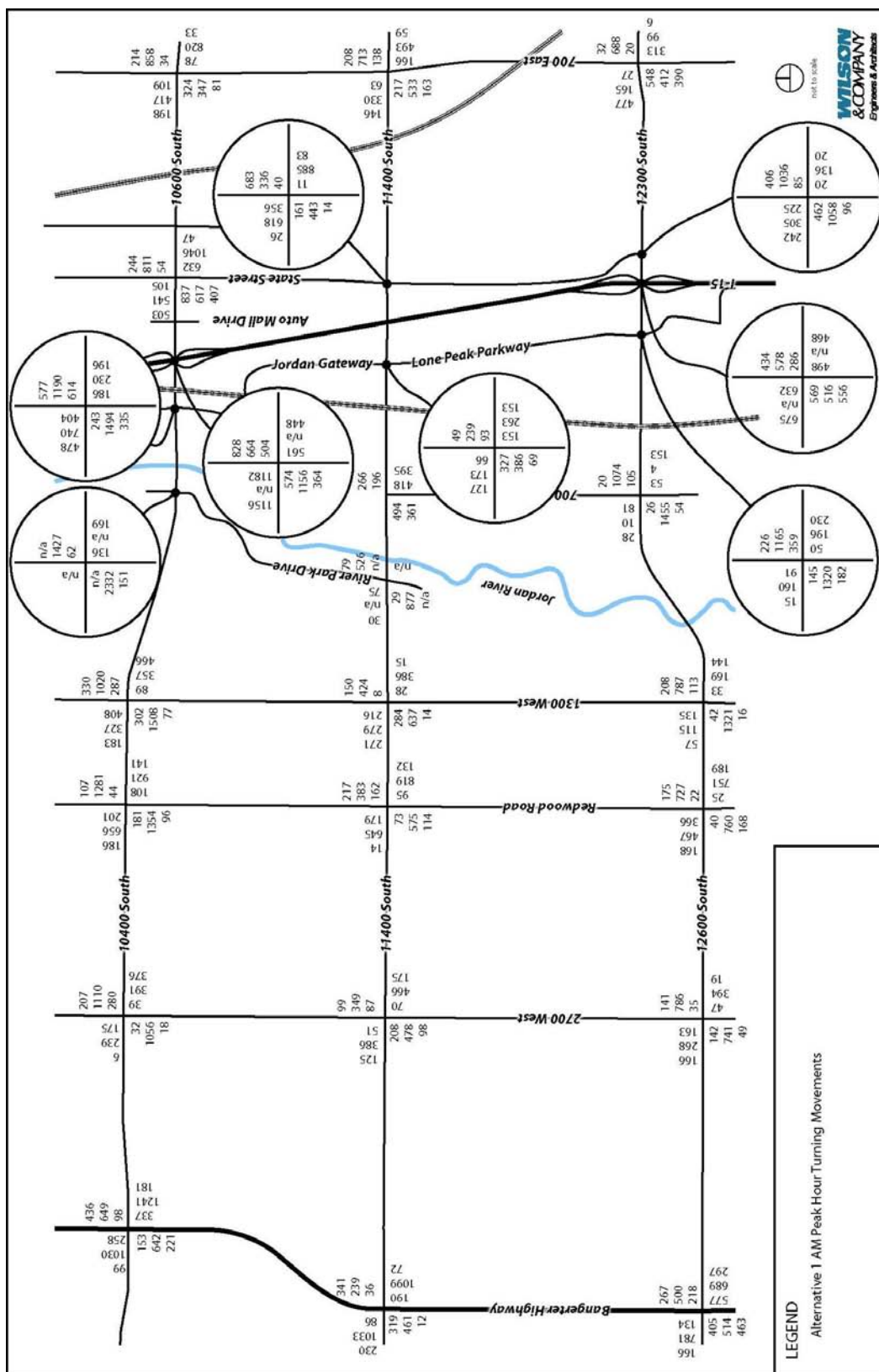
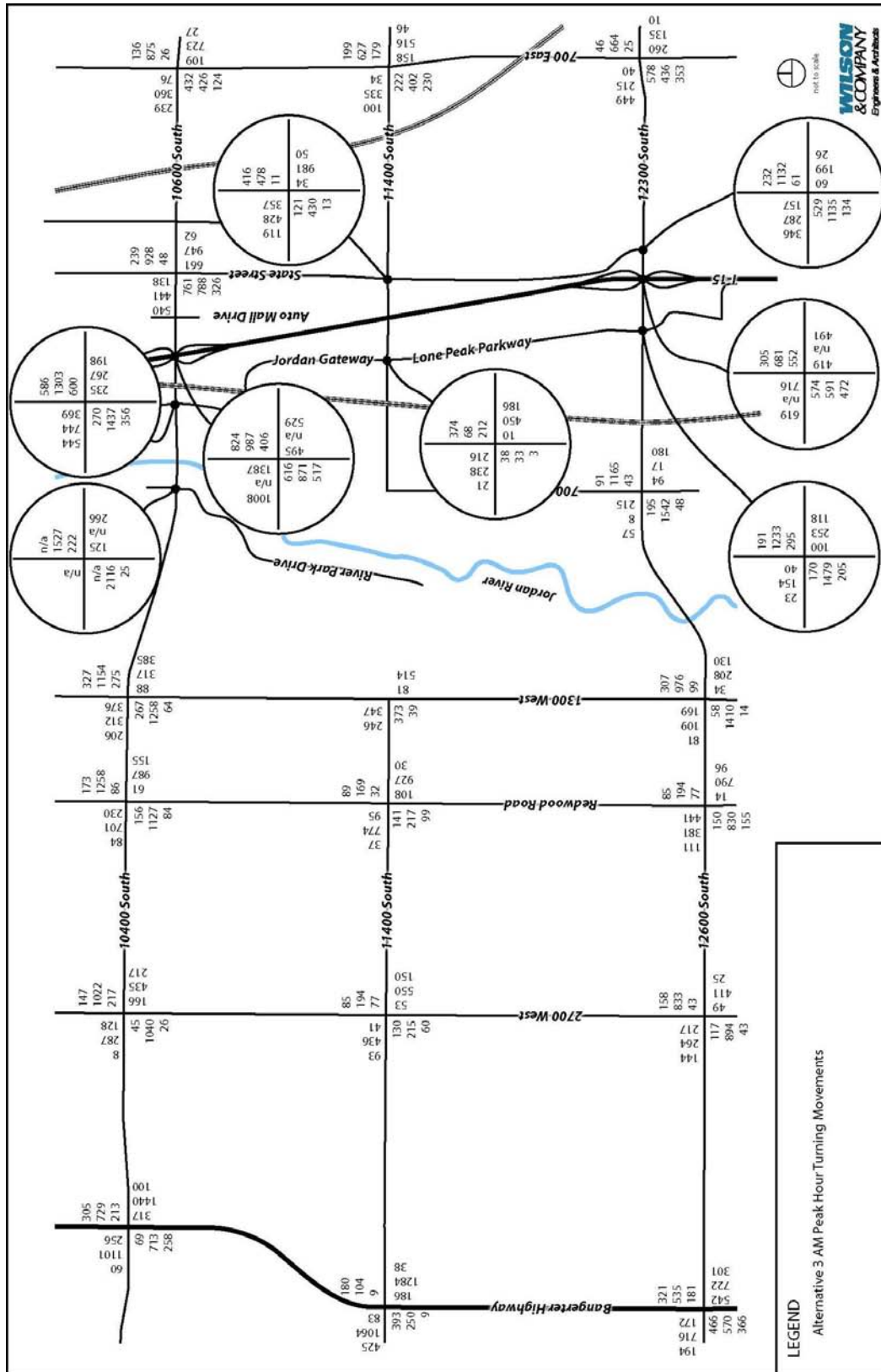


Figure 10. Alternative 3(a) AM Peak Hour Turning Movements



### Figure 11. Alternative 4 AM Peak Hour Turning Movements

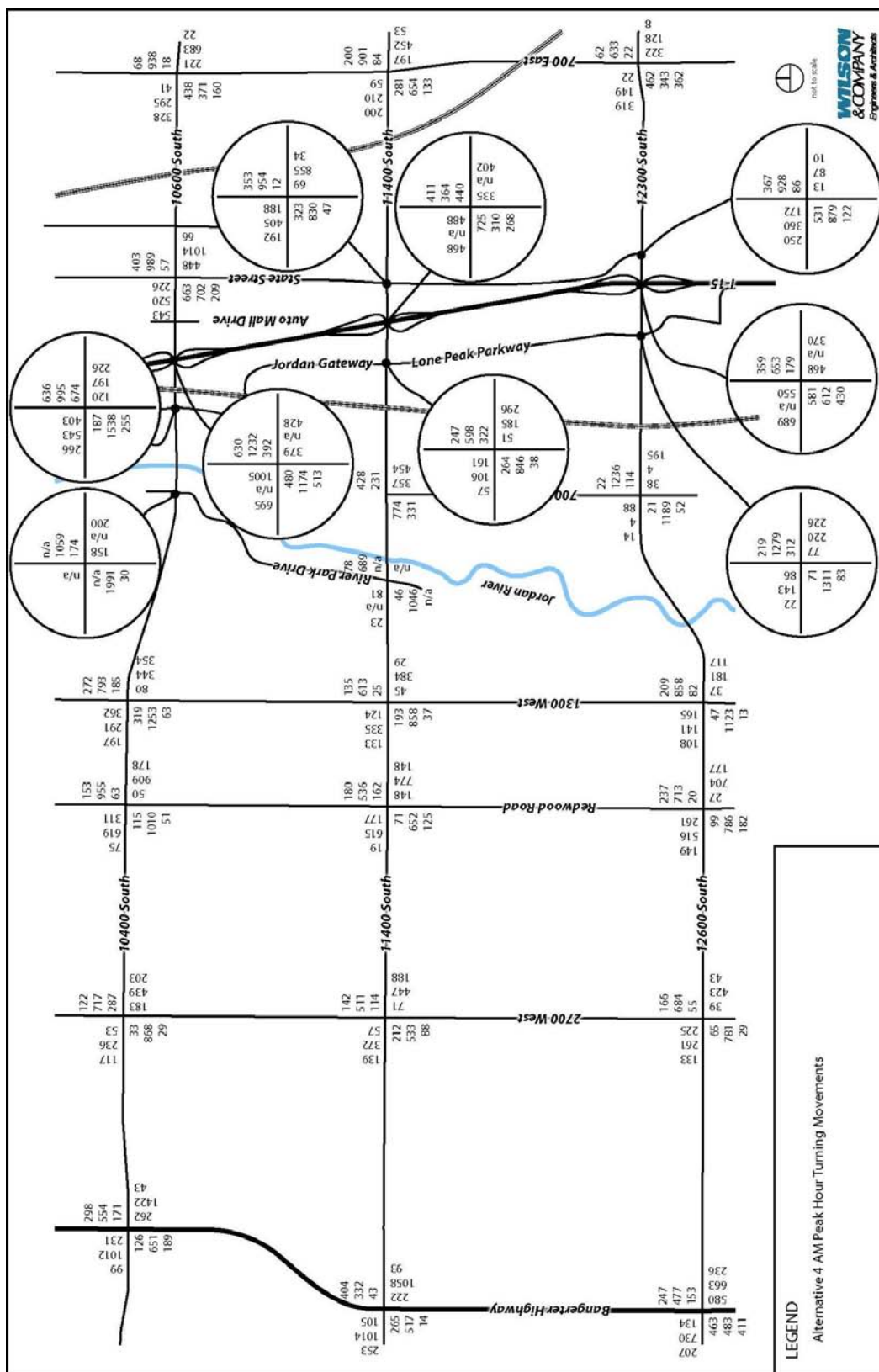
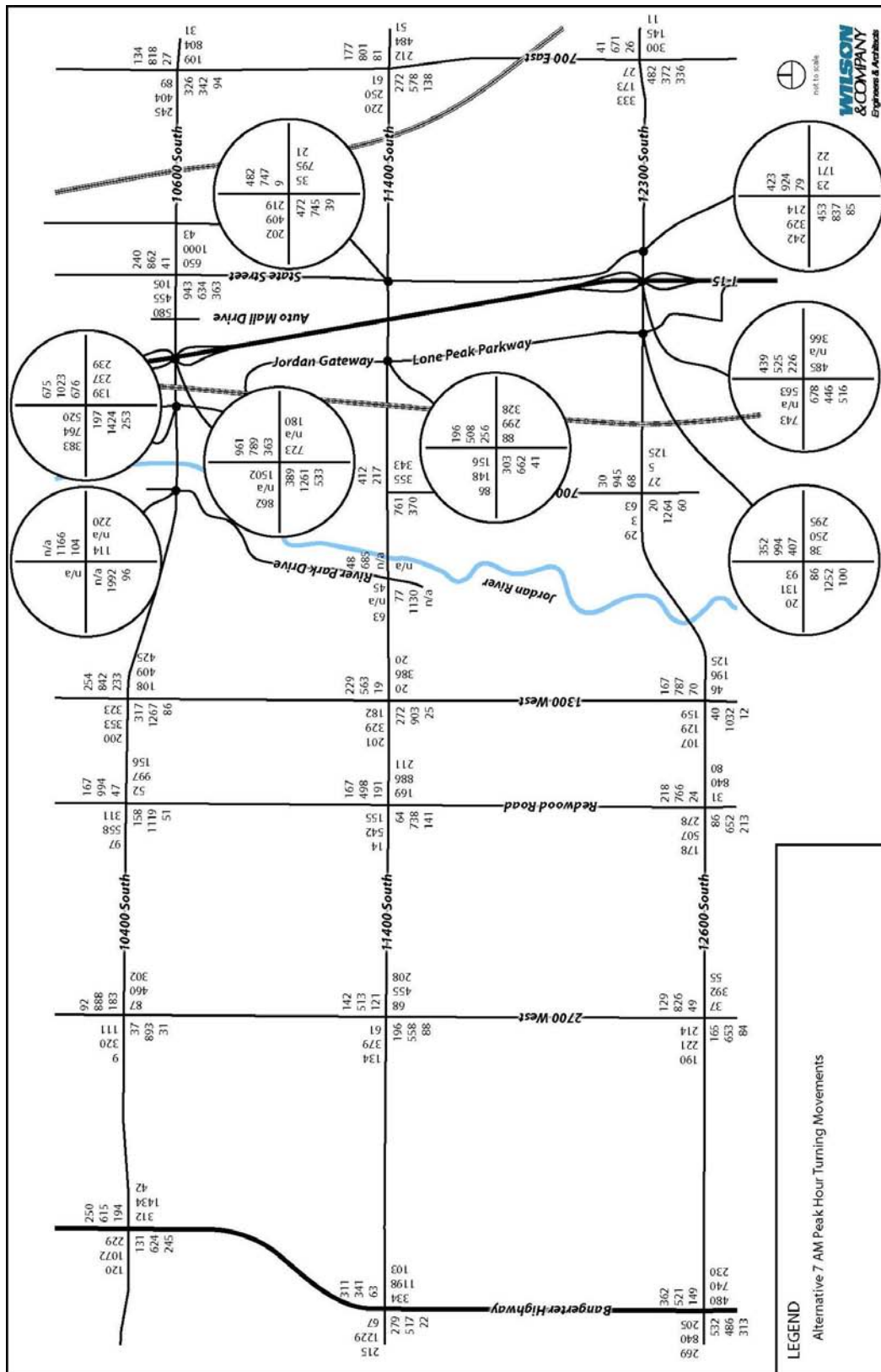


Figure 12. Alternative 7 AM Peak Hour Turning Movements



Technical Memorandum  
PM Peak Hour Data Development  
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## I. Development of PM Peak Hour Percentages and Volumes<sup>1</sup>

Afternoon peak hour volumes were based on existing peak hour percentages and peak hour percentages derived from the model. These peak hour percentages were applied to the network volumes generated as detailed in the **Technical Memorandum – Initial Screening Model Development** to set PM peak hour inbound and outbound intersection volumes for the 28 major intersections and interstate ramp terminals in the project area.

Final PM peak hour percentages and volumes for each intersection and alternative are shown in the Appendix, **Figures 1 through 18**.

## II. Development of PM Turning Movements

Afternoon peak hour turning movements were based on existing peak hour turning movement percentages and the turning movement percentages from the No-Action model. These turning movement percentages were generated for each intersection and applied to each alternative in the project area to set PM peak hour turning movement volumes for the 28 major intersections and interstate ramp terminals in the project area.

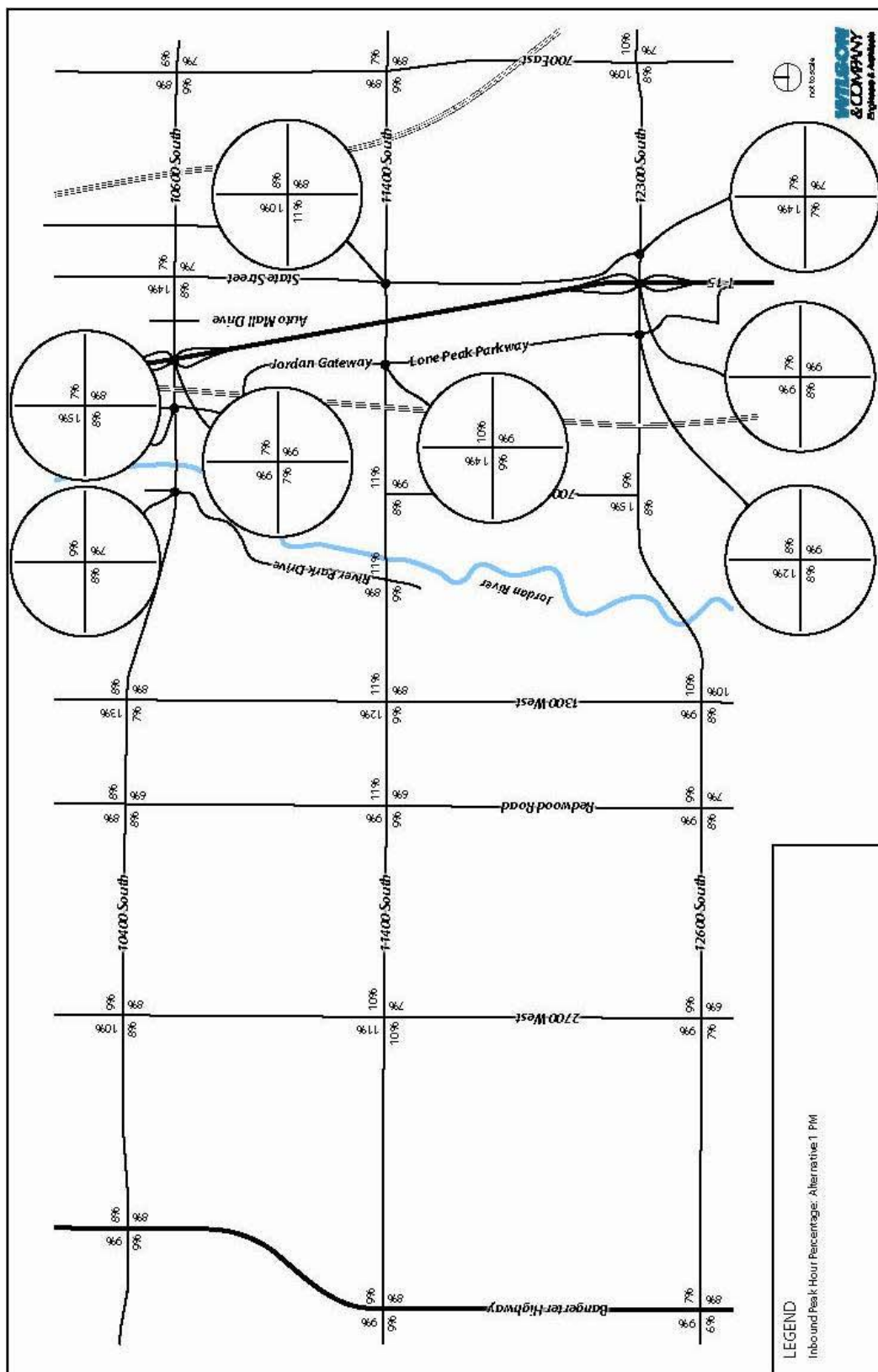
Final PM peak hour turning movements for each intersection and alternative are shown in the Appendix, **Figures 19 through 27**.

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<sup>1</sup> PM volumes were developed for Alternatives 1-7, and 9 used for the first screening analysis.

## Appendix

Figure 1. Alternative 1 PM Peak Hour Percentages



### Figure 2. Alternative 2 PM Peak Hour Percentages

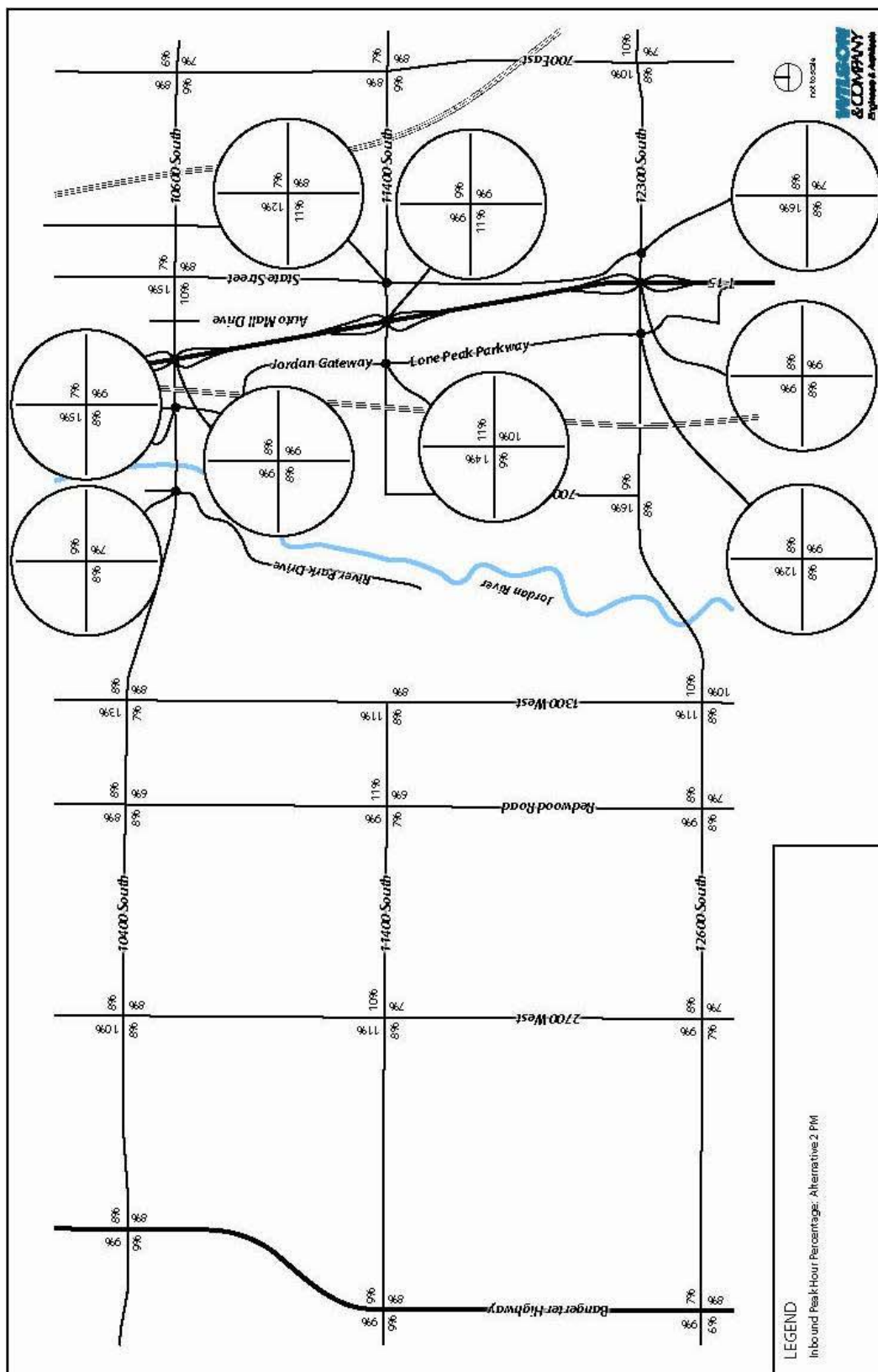


Figure 3. Alternative 3a PM Peak Hour Percentages

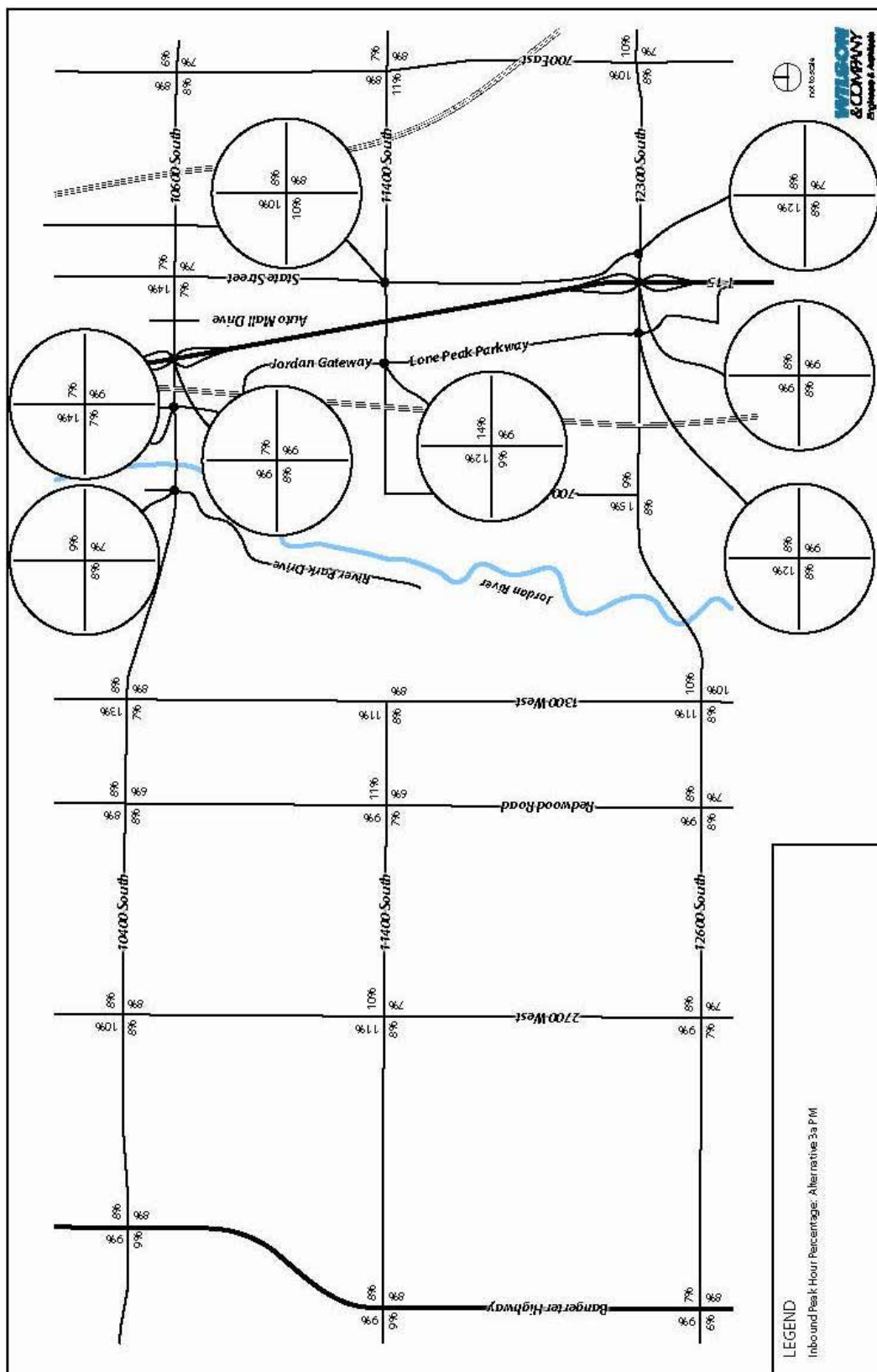


Figure 4. Alternative 3b PM Peak Hour Percentages

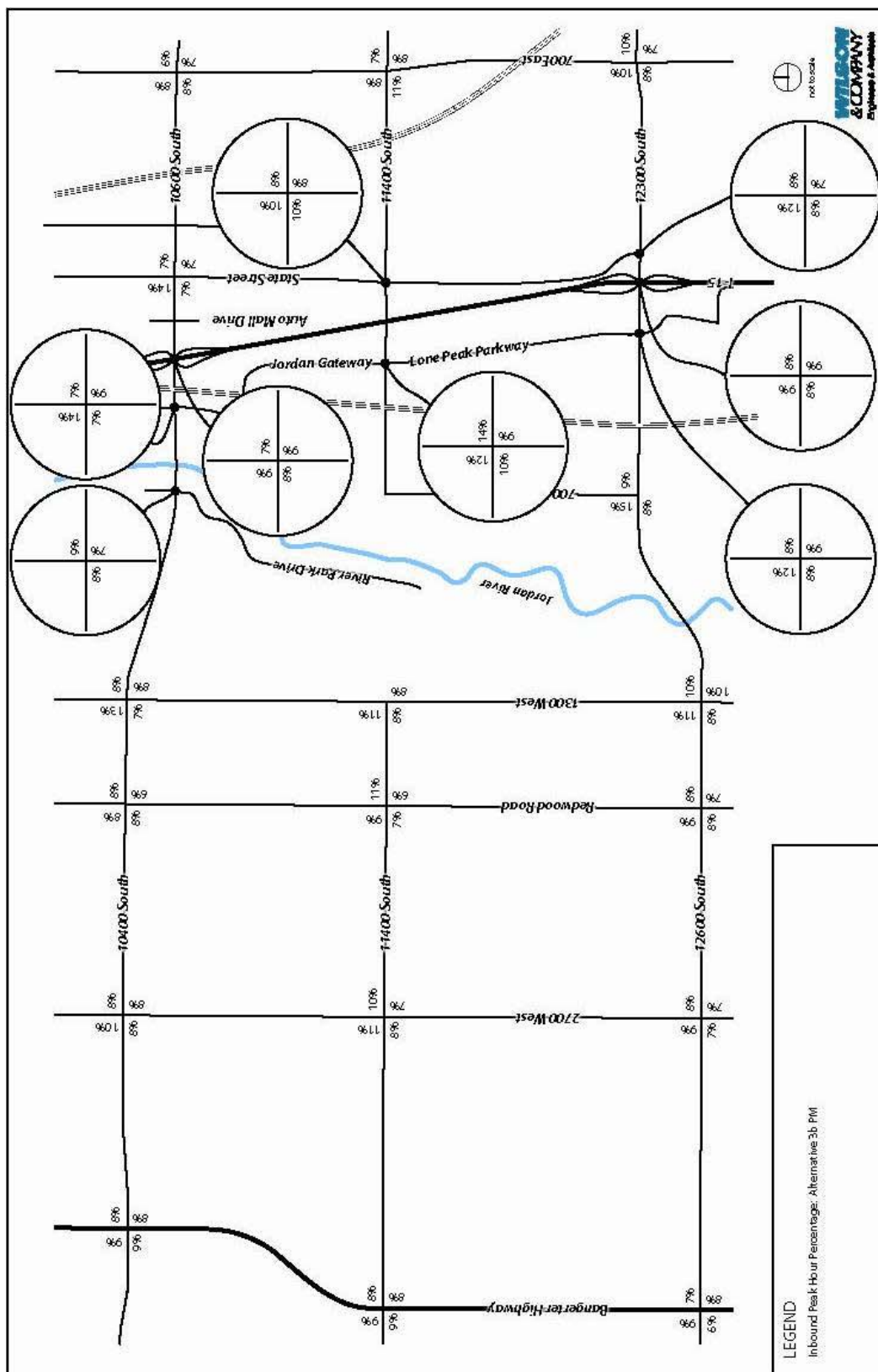


Figure 5. Alternative 4 PM Peak Hour Percentages

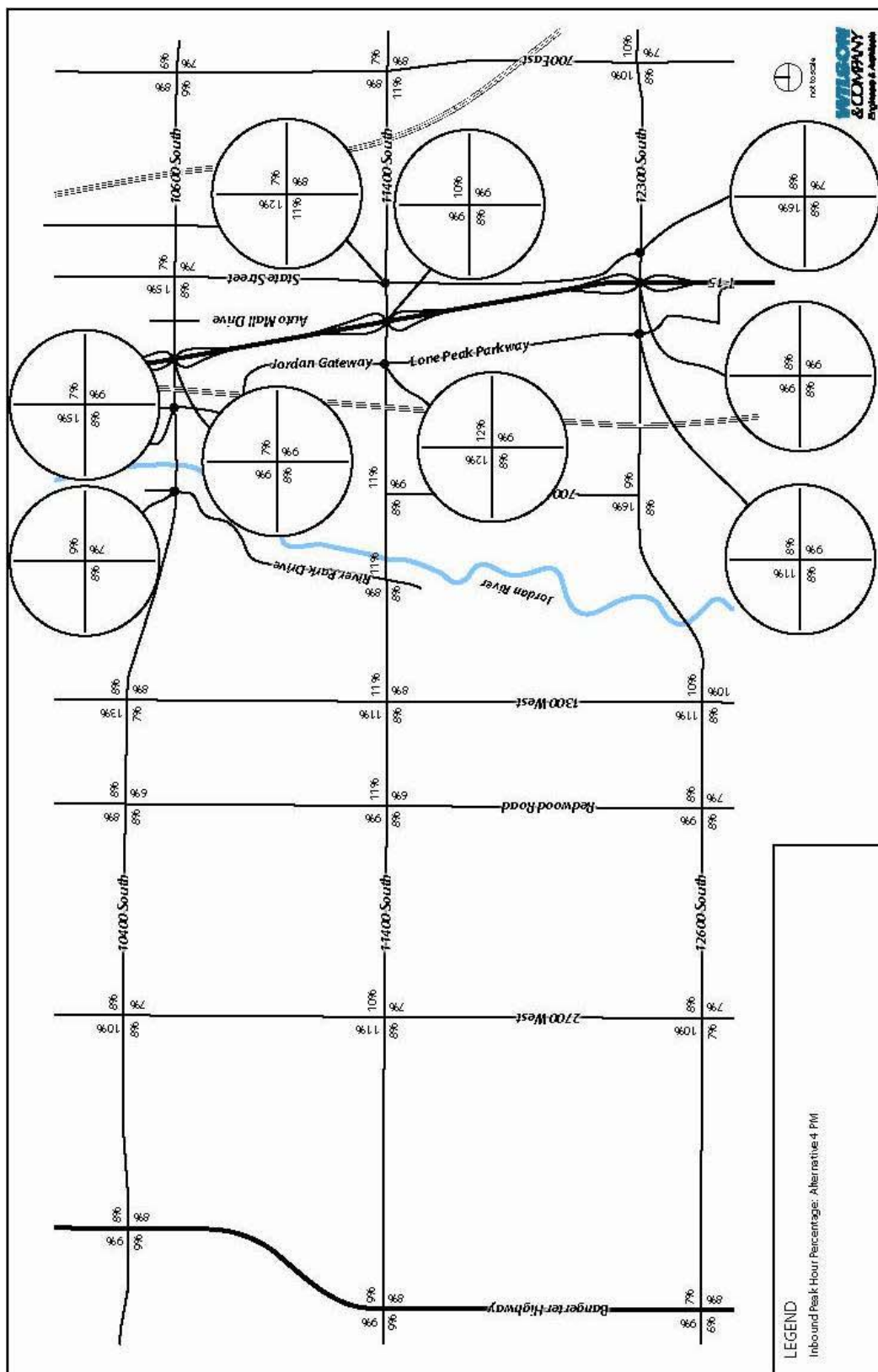
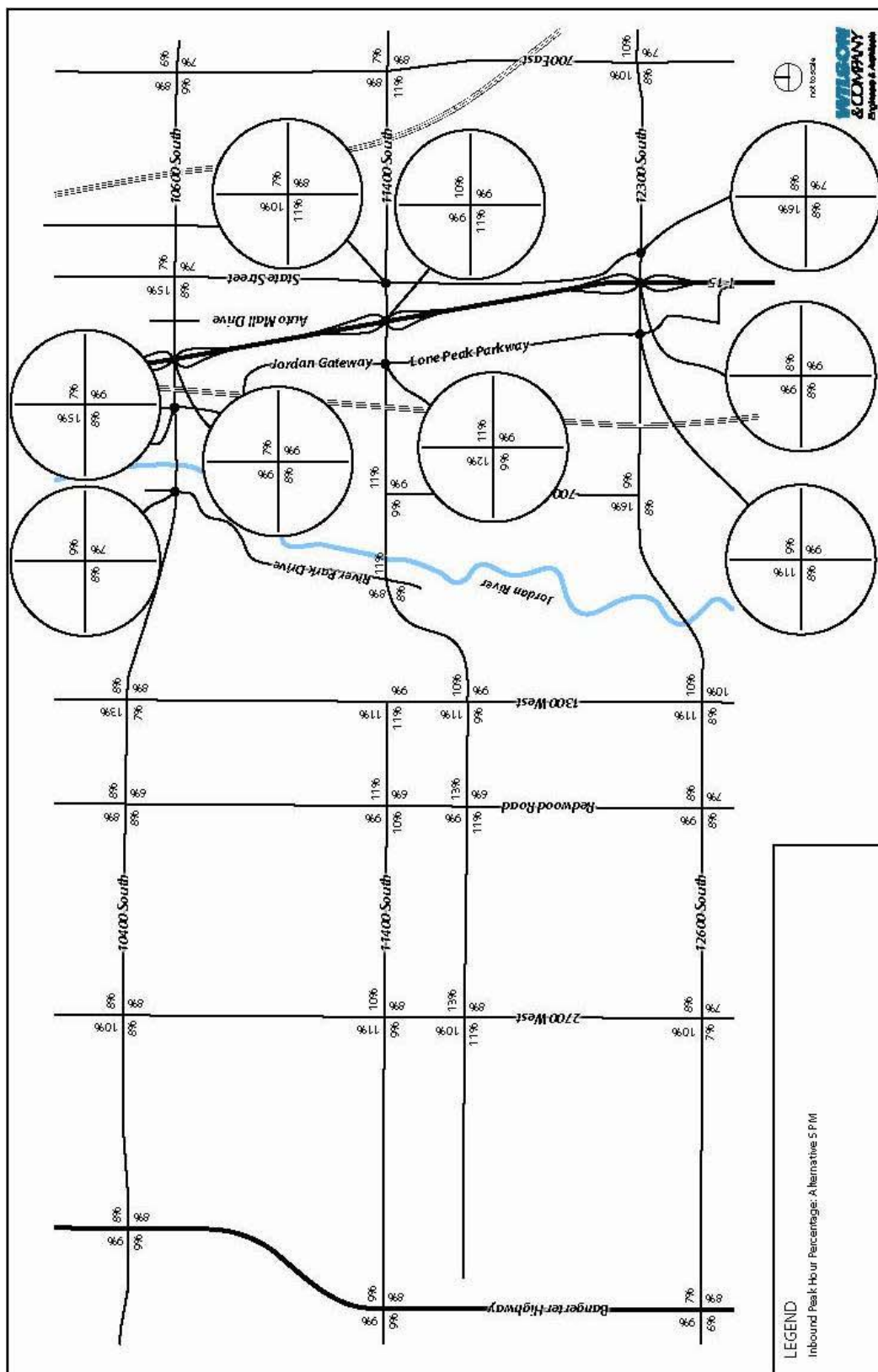


Figure 6. Alternative 5 PM Peak Hour Percentages



### Figure 7. Alternative 6 PM Peak Hour Percentages

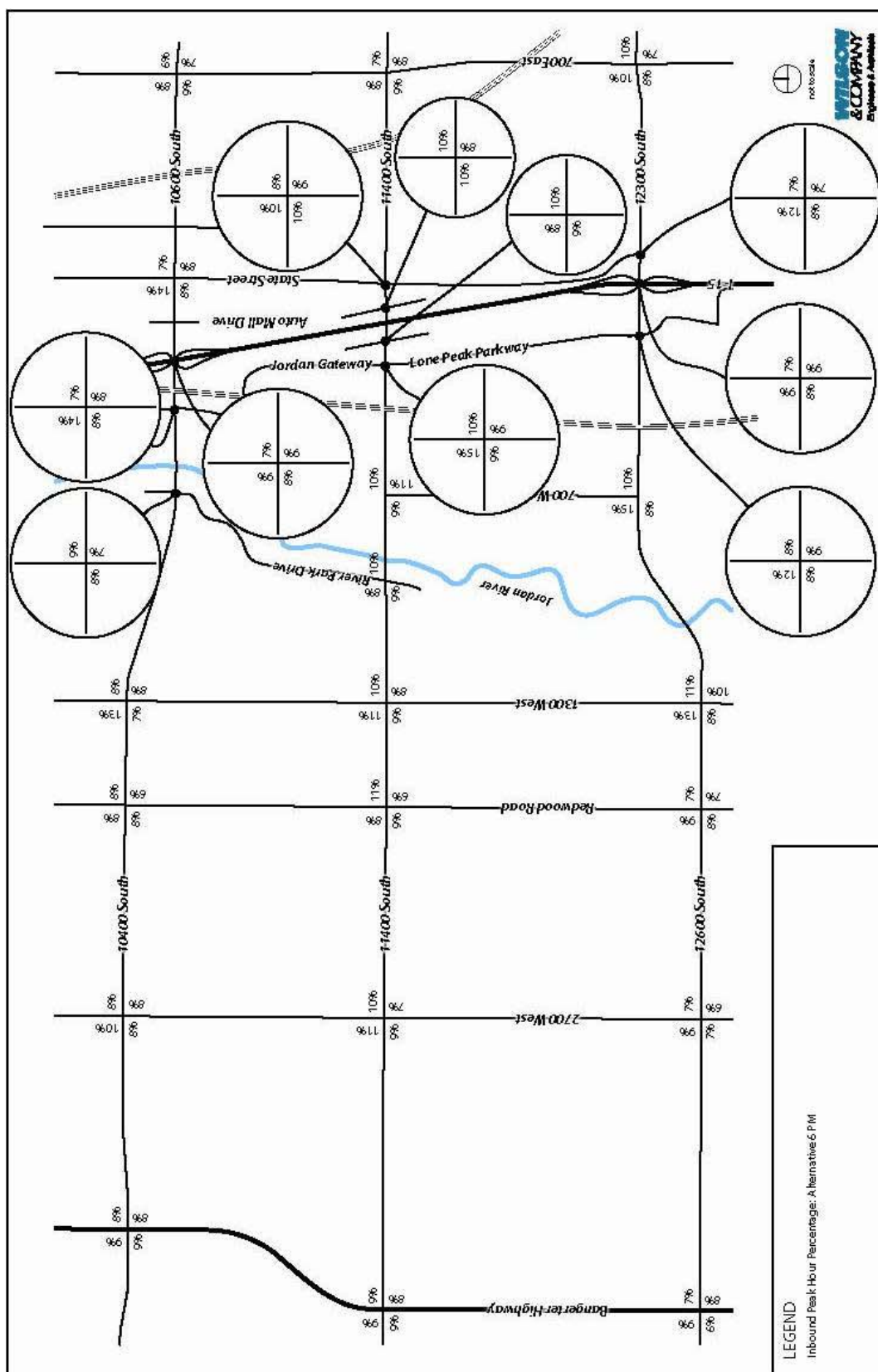
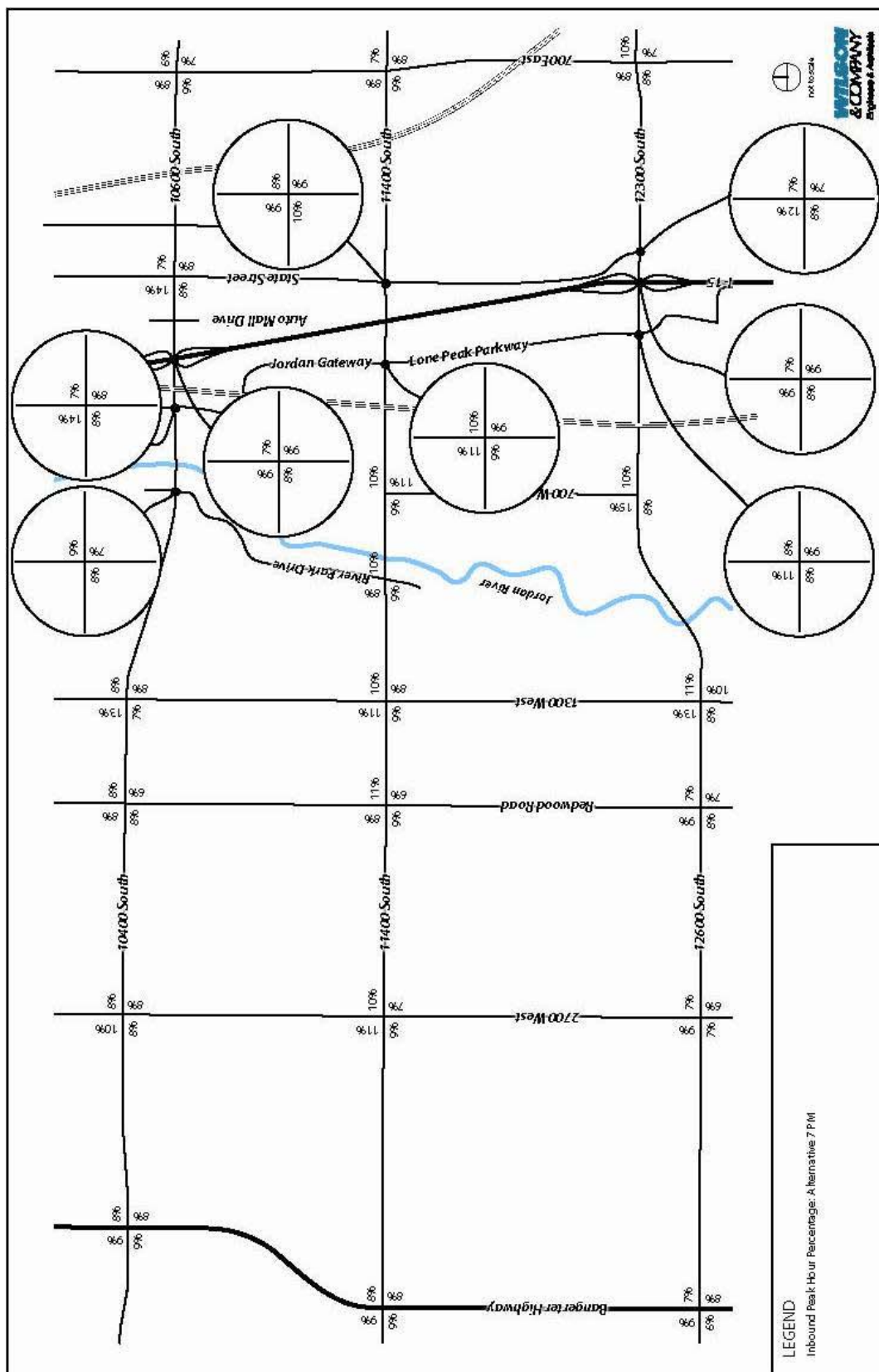


Figure 8. Alternative 7 PM Peak Hour Percentages



### Figure 9. Alternative 9 PM Peak Hour Percentages

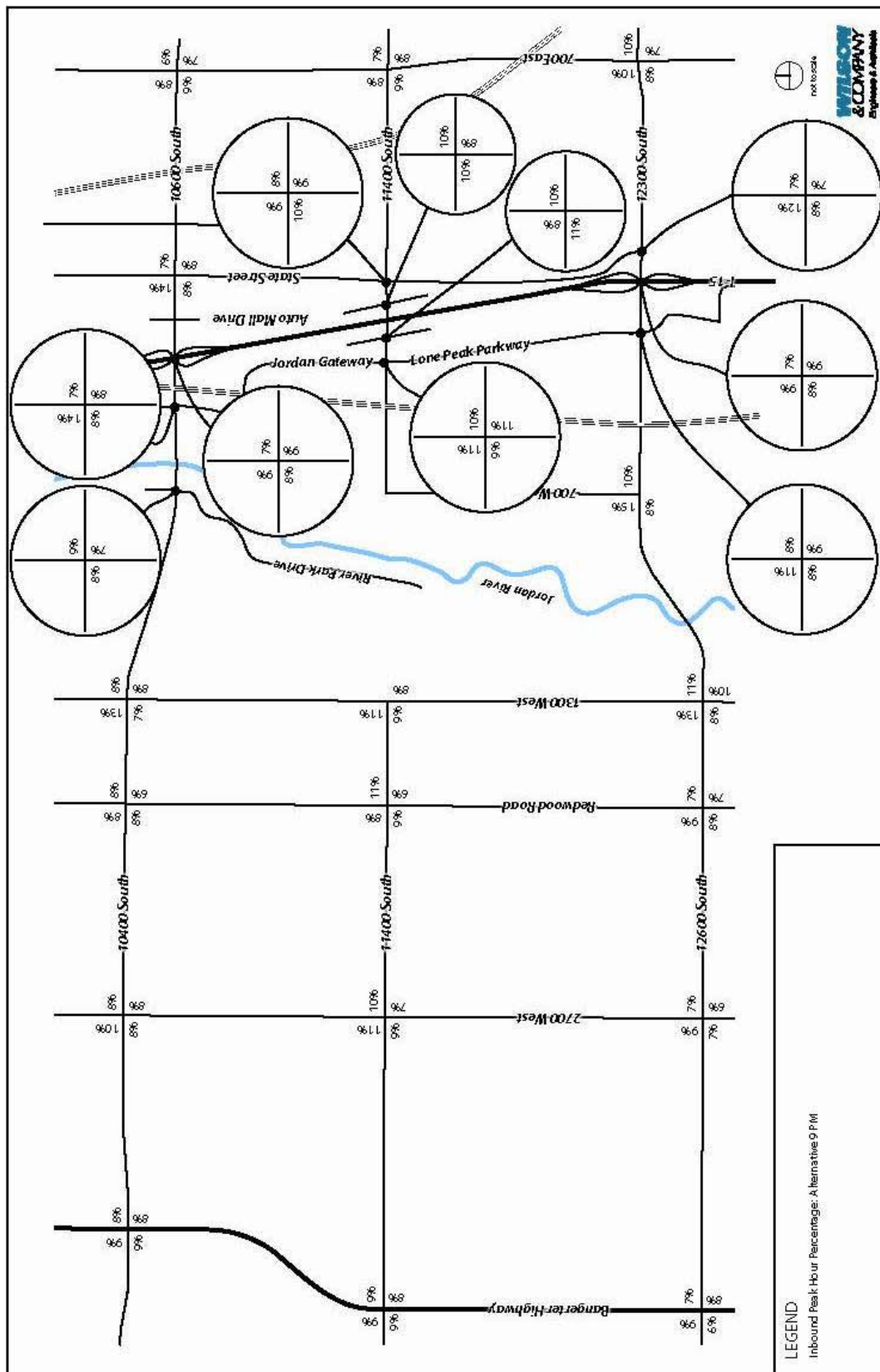
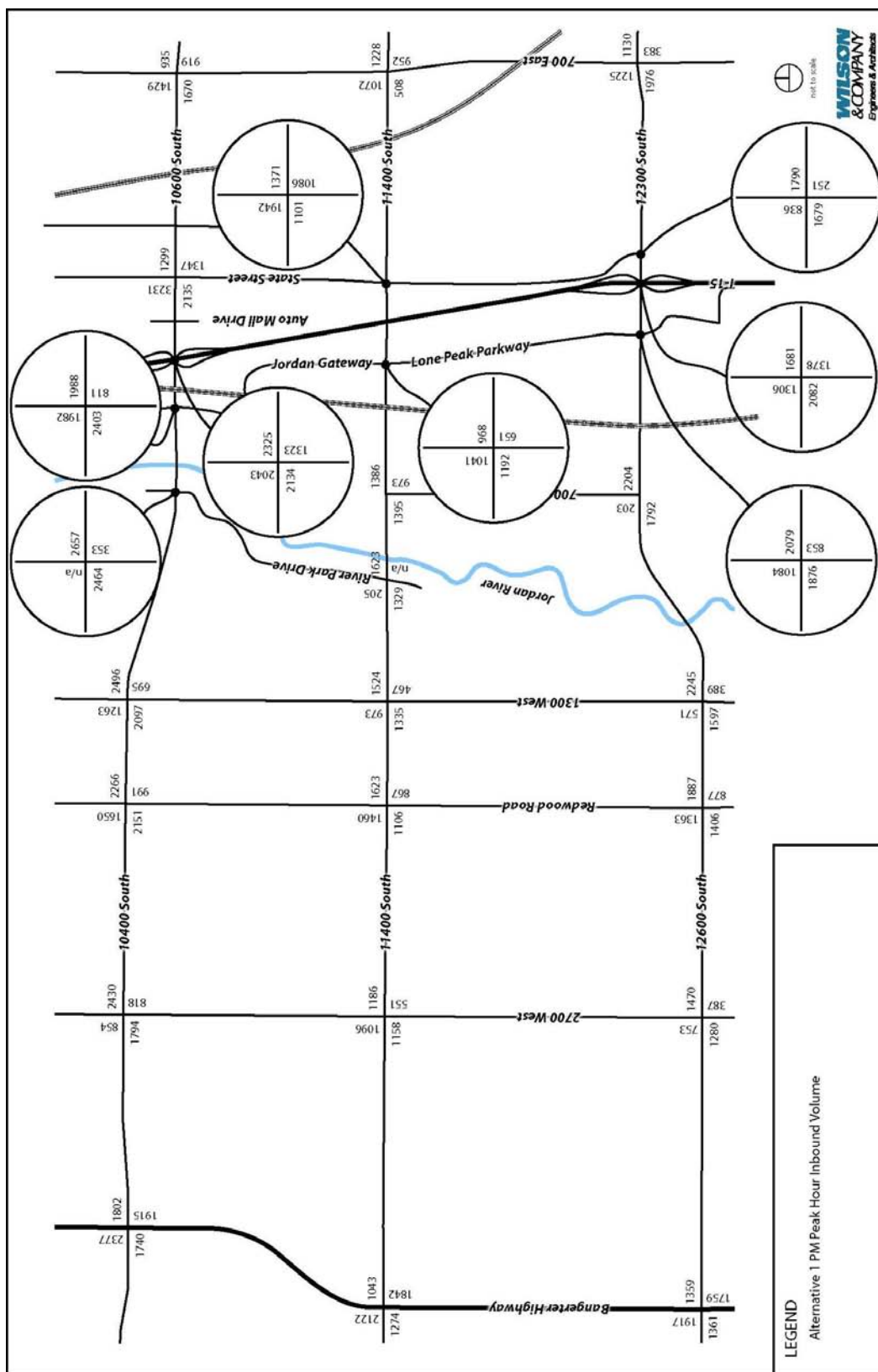
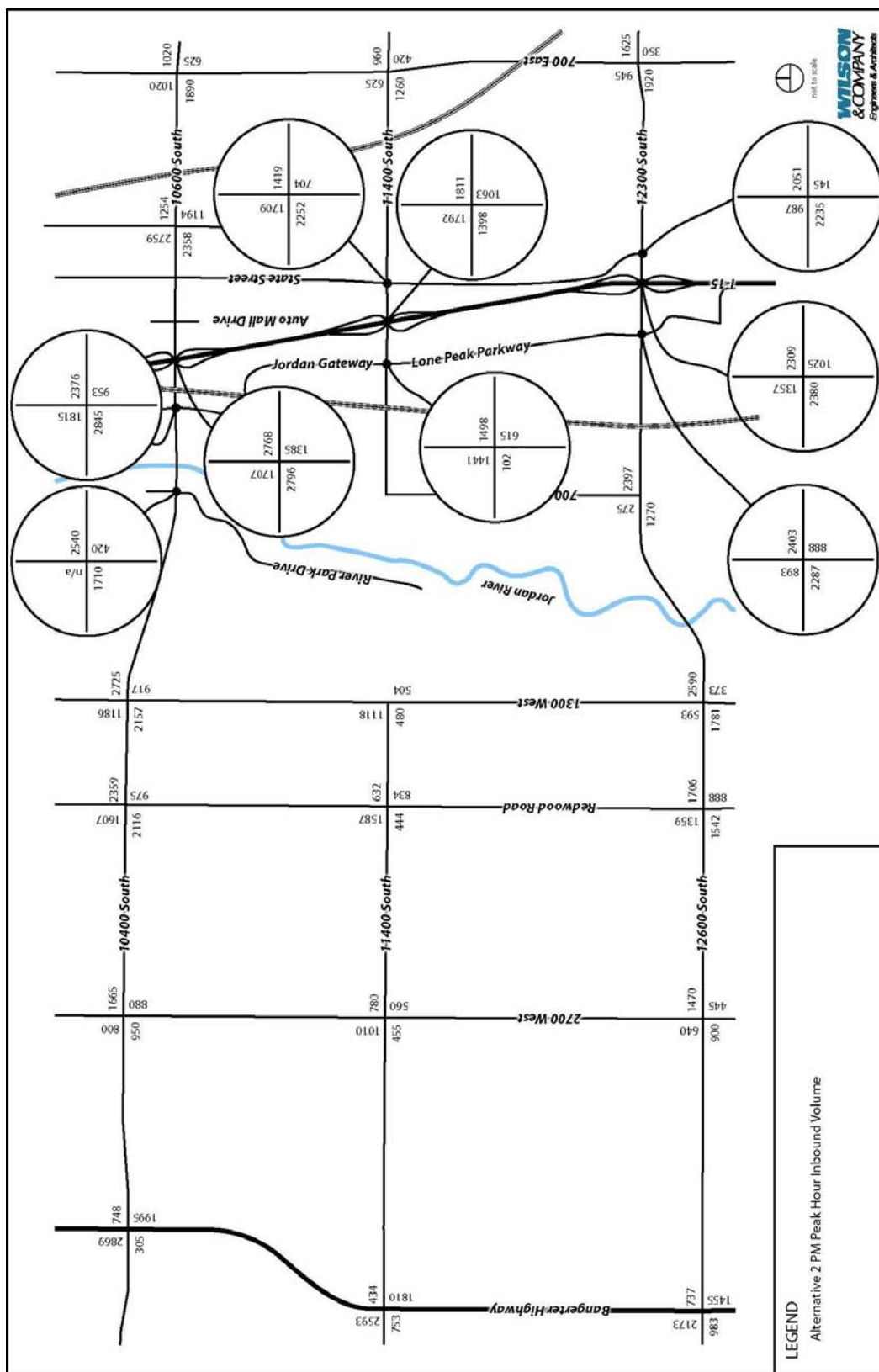


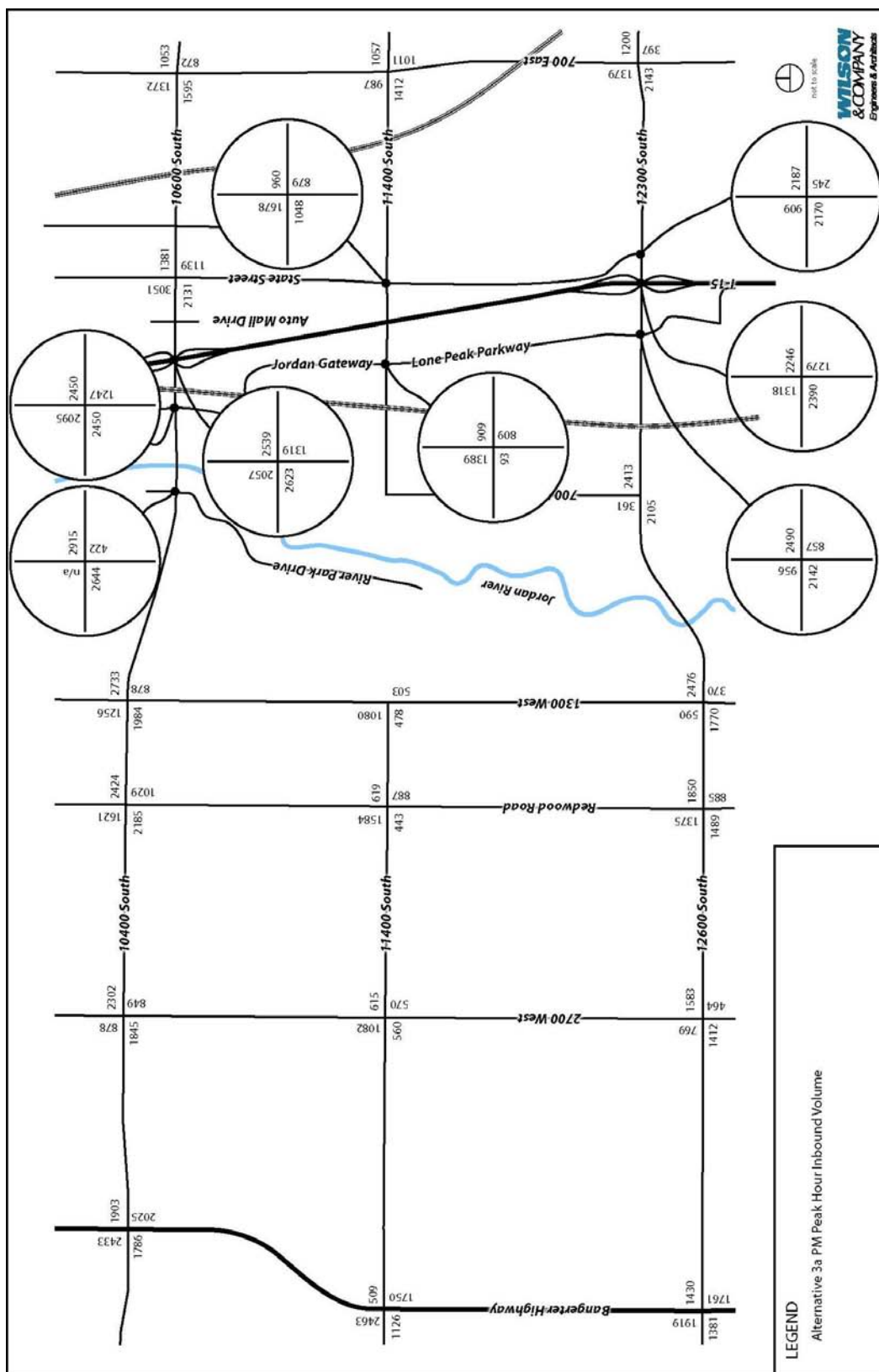
Figure 10. Alternative 1 PM Peak Hour Inbound Volumes



### Figure 11. Alternative 2 PM Peak Hour Inbound Volumes



**Figure 12. Alternative 3a PM Peak Hour Inbound Volumes**



**Figure 13. Alternative 3b PM Peak Hour Inbound Volumes**

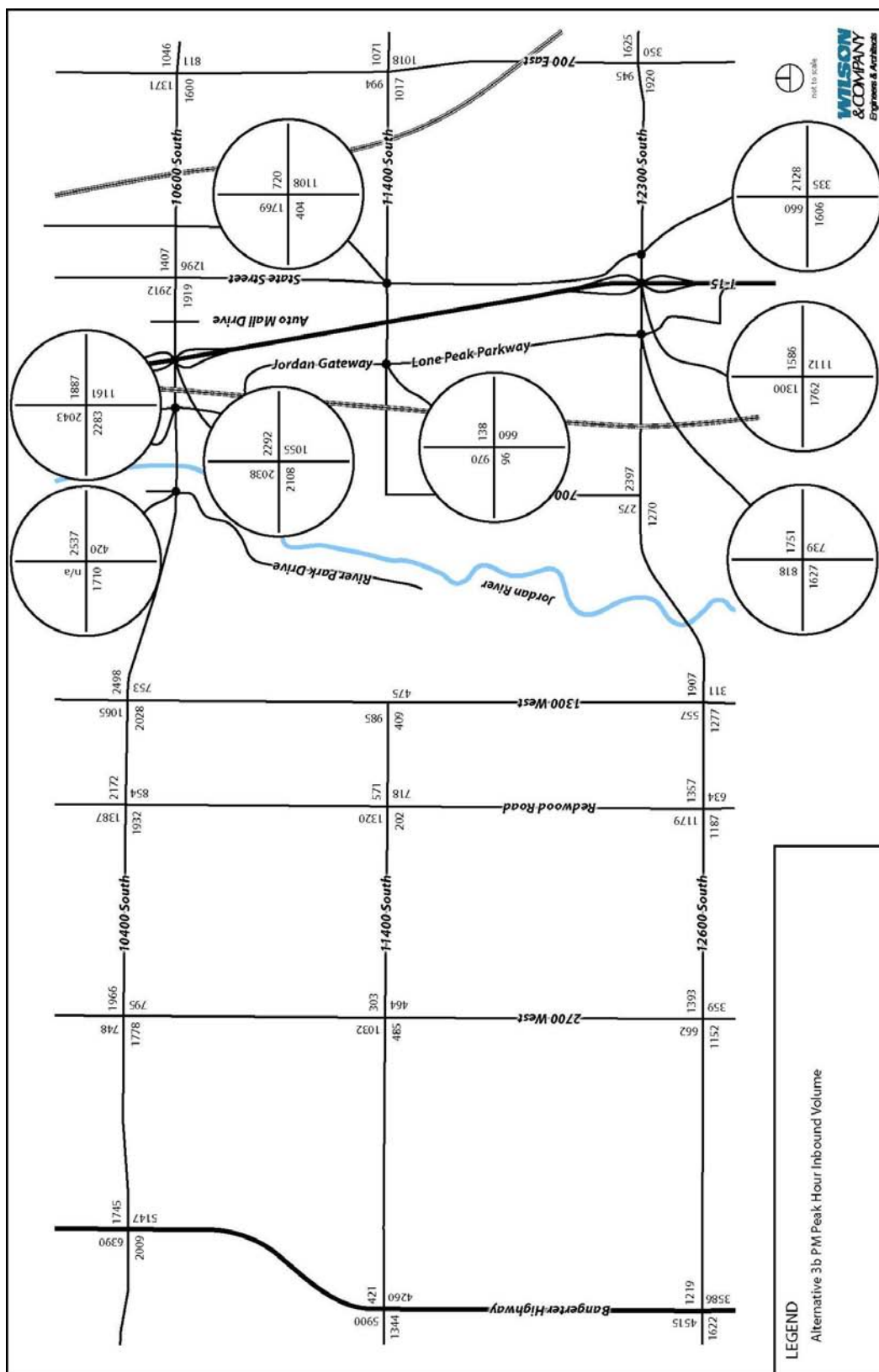


Figure 14. Alternative 4 PM Peak Hour Inbound Volumes

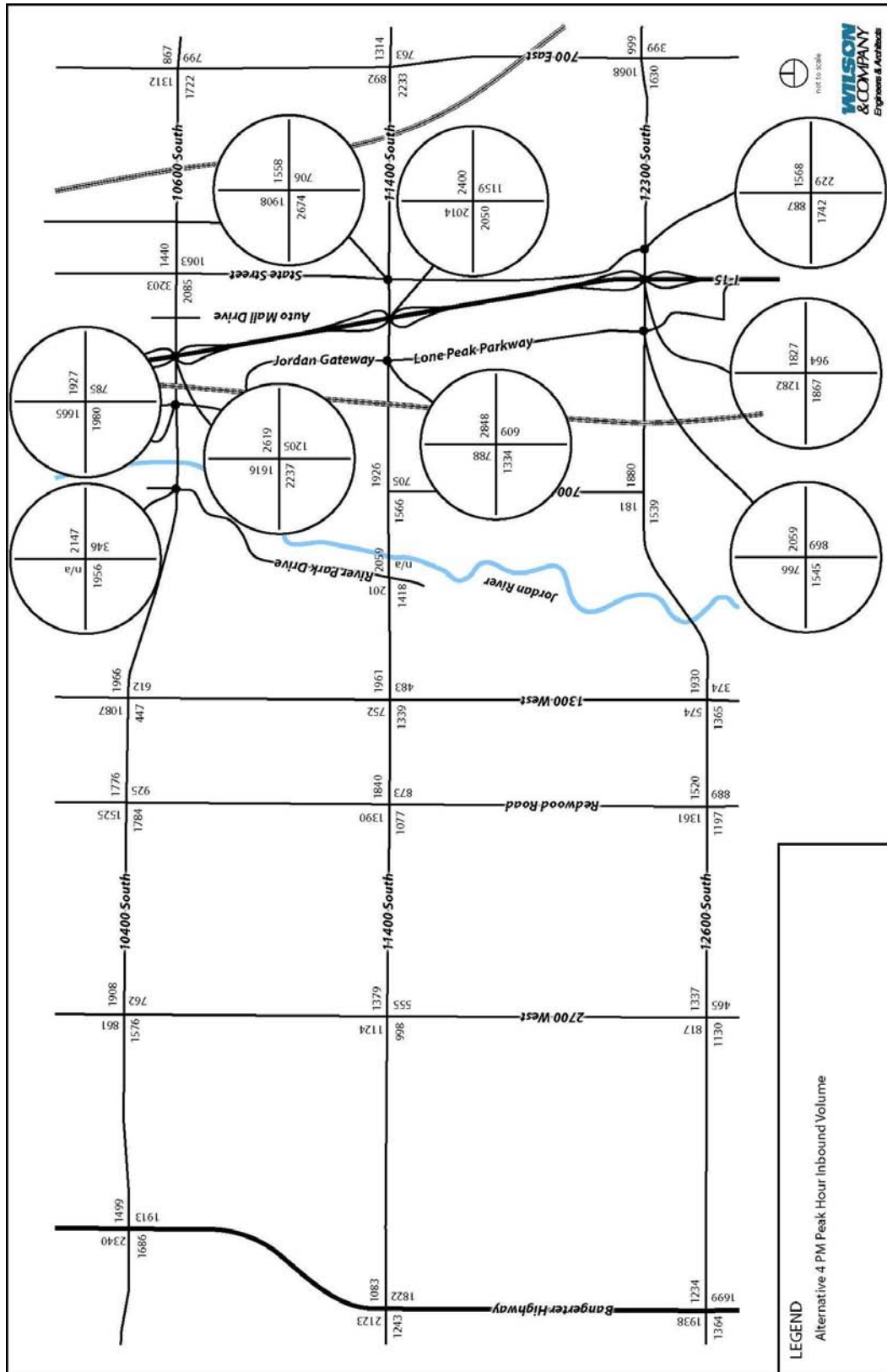
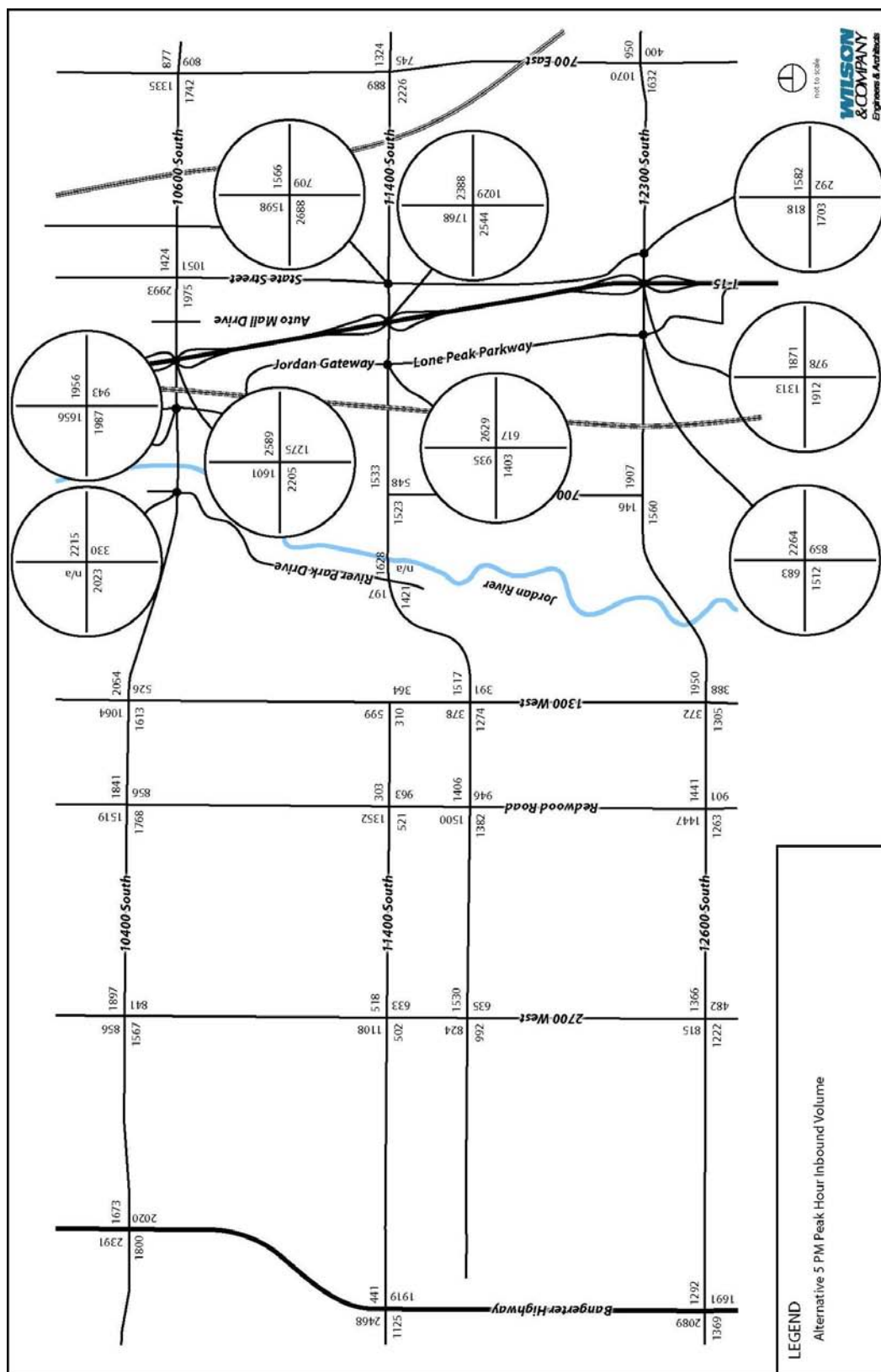
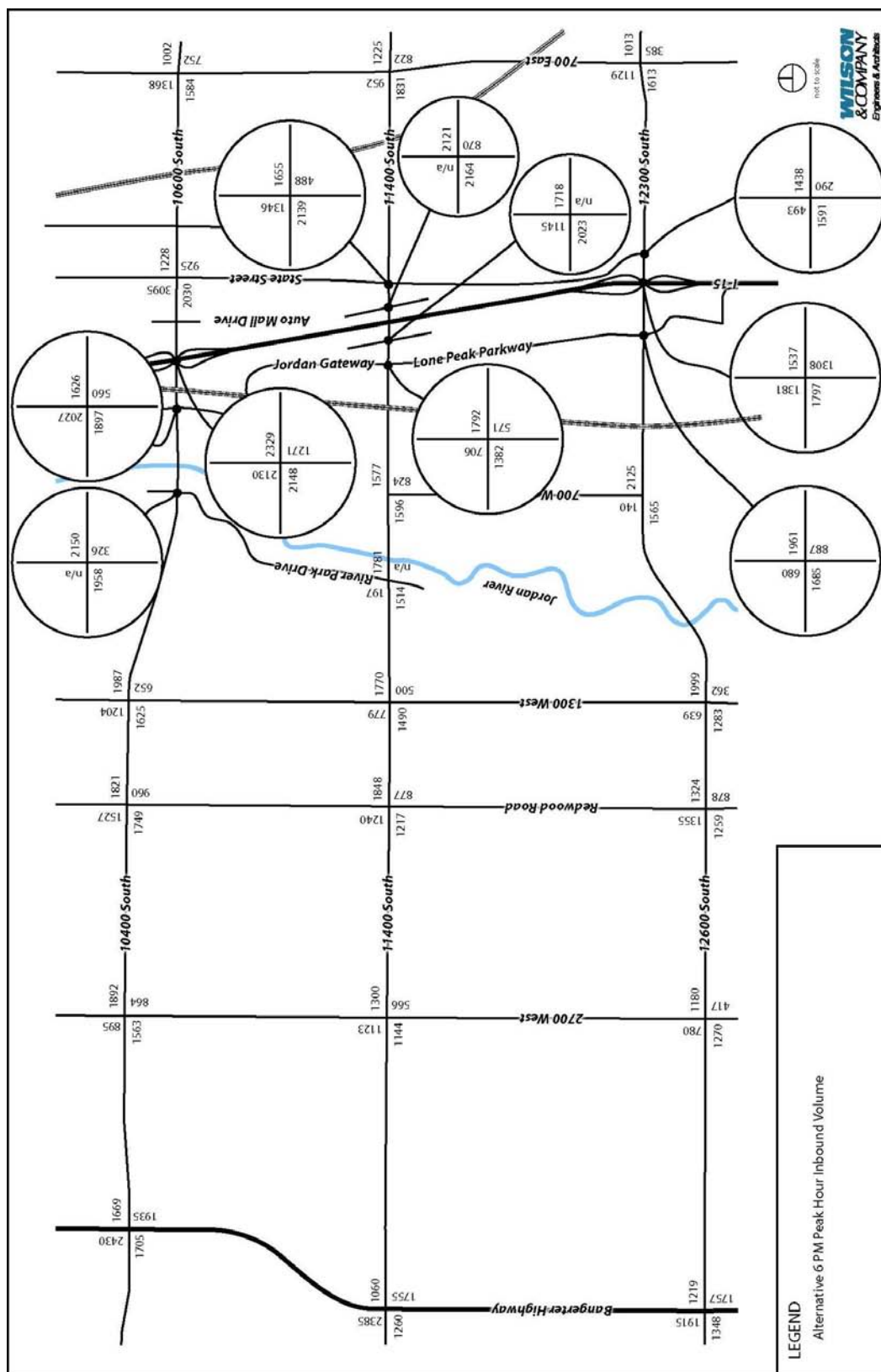


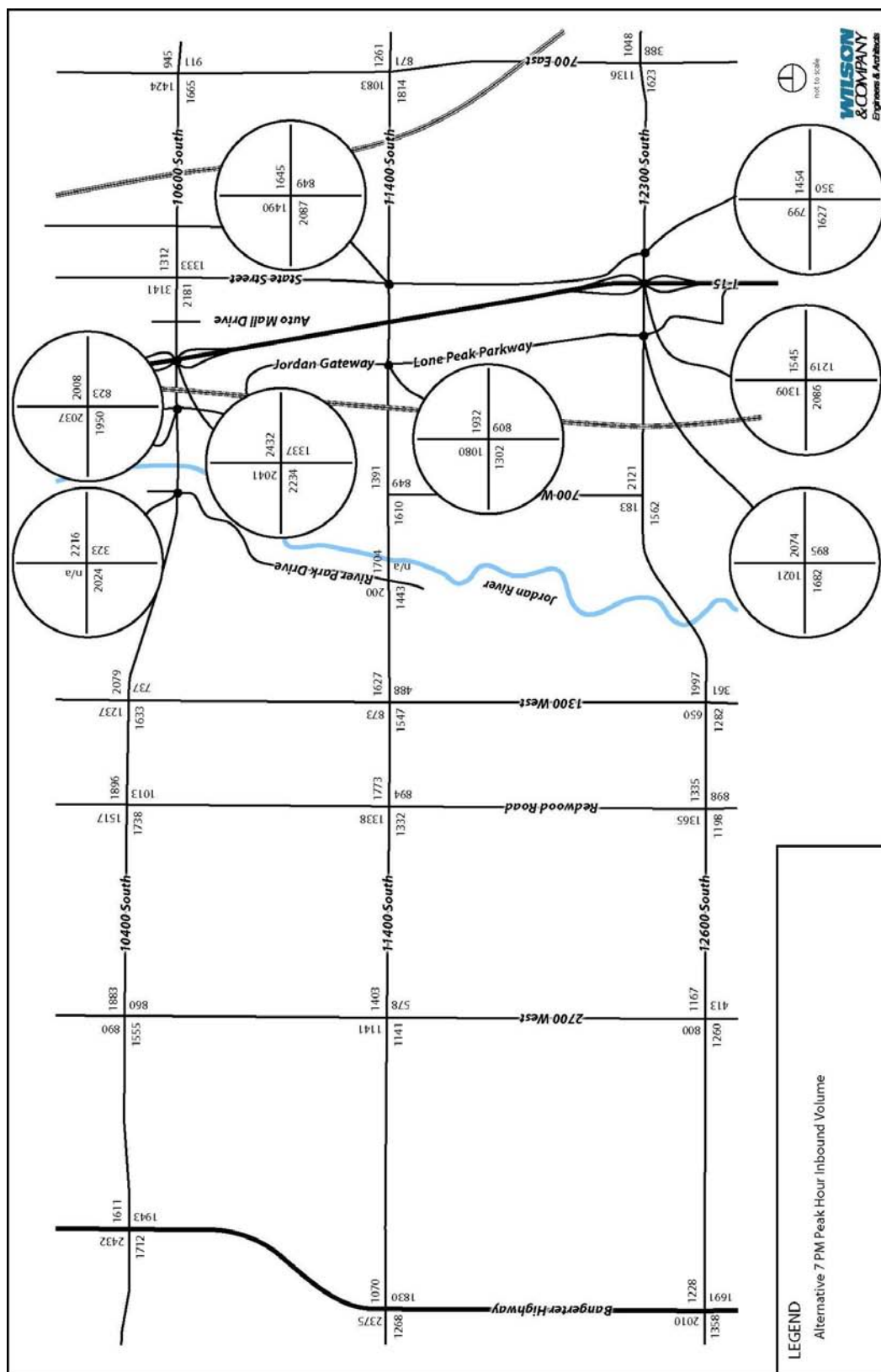
Figure 15. Alternative 5 PM Peak Hour Inbound Volumes



**Figure 16. Alternative 6 PM Peak Hour Inbound Volumes**



### Figure 17. Alternative 7 PM Peak Hour Inbound Volumes



**Figure 18. Alternative 9 PM Peak Hour Inbound Volumes**

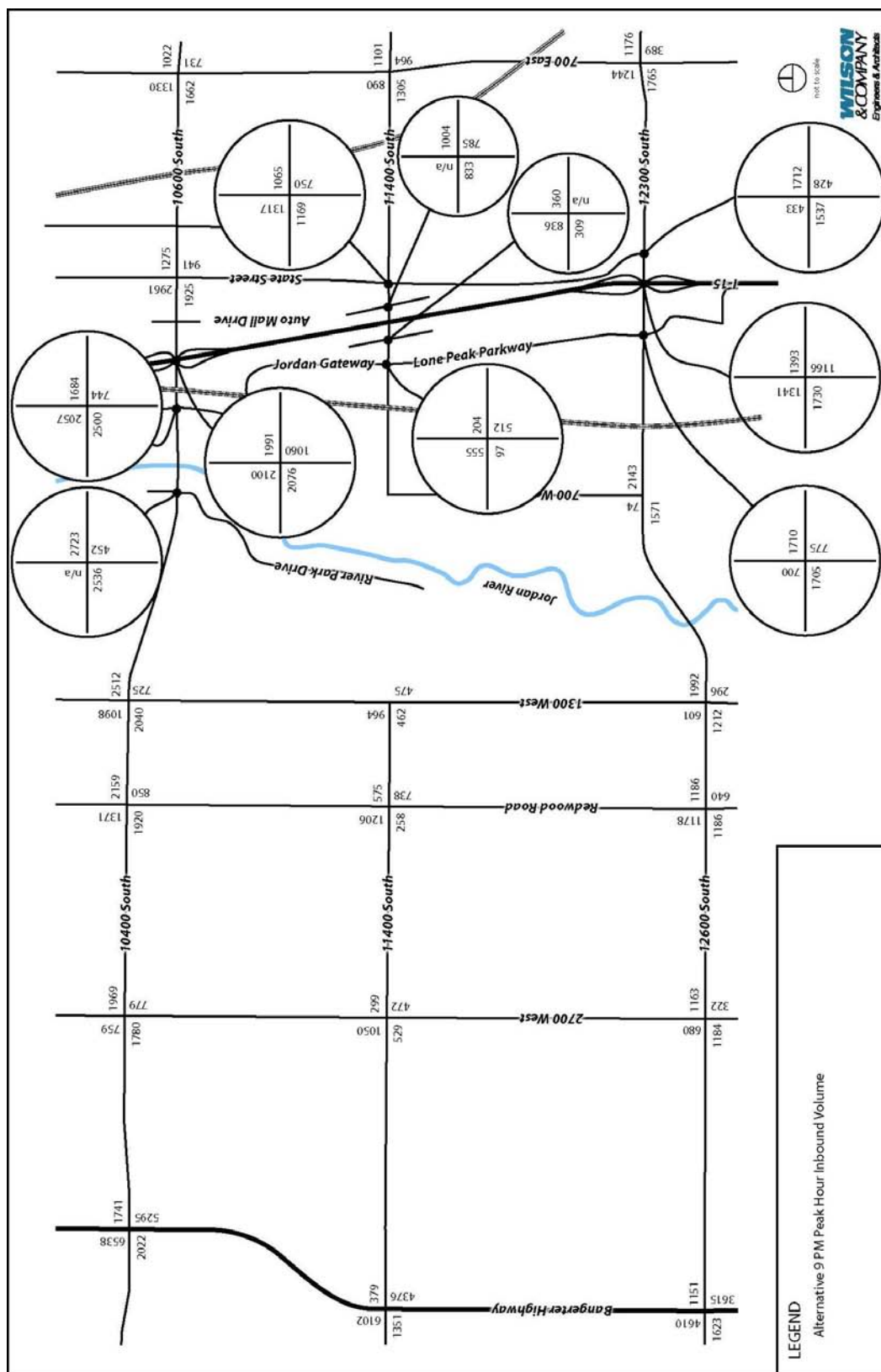


Figure 19. Alternative 1 PM Peak Hour Turning Movements

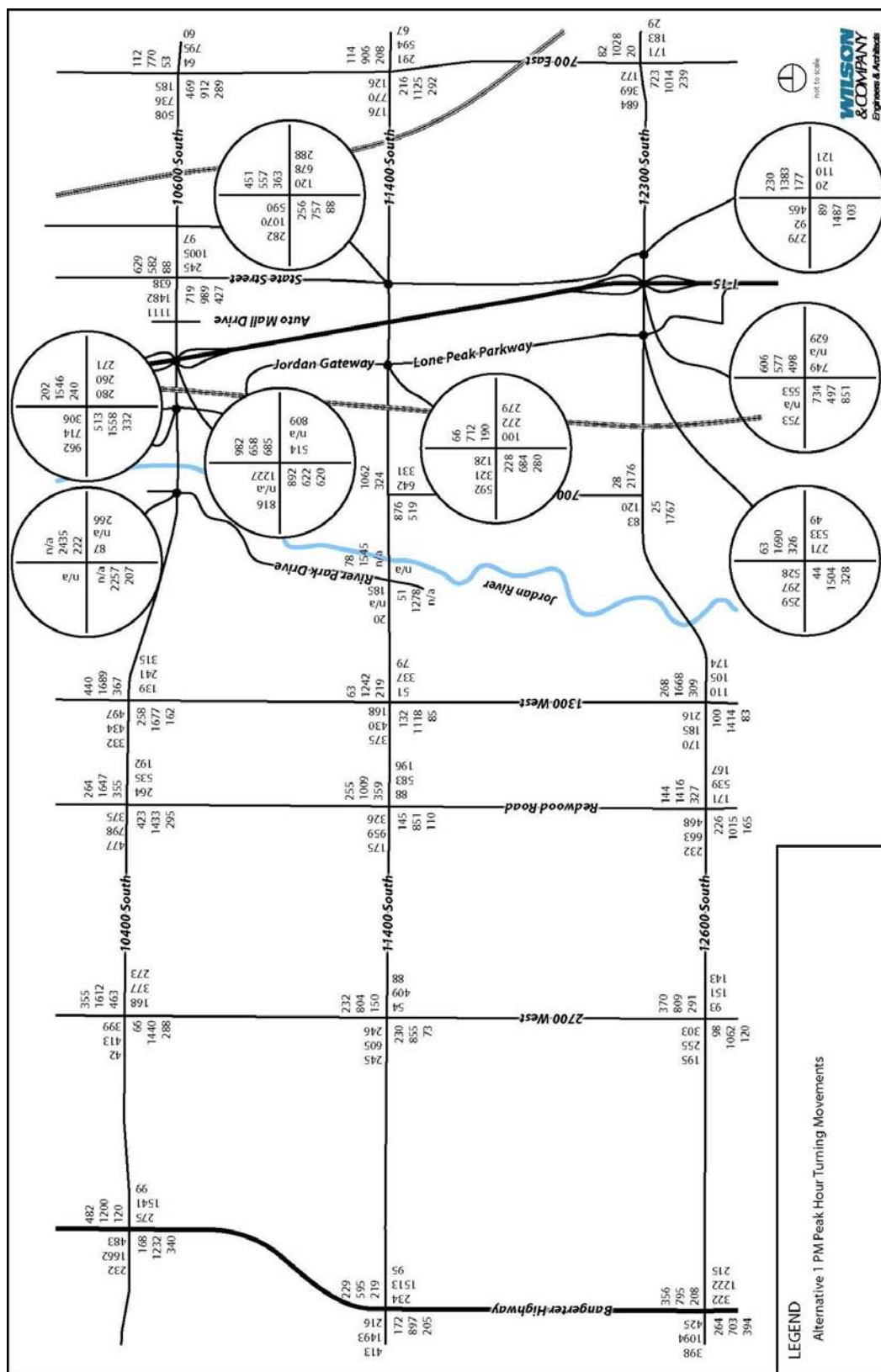


Figure 20. Alternative 2 PM Peak Hour Turning Movements

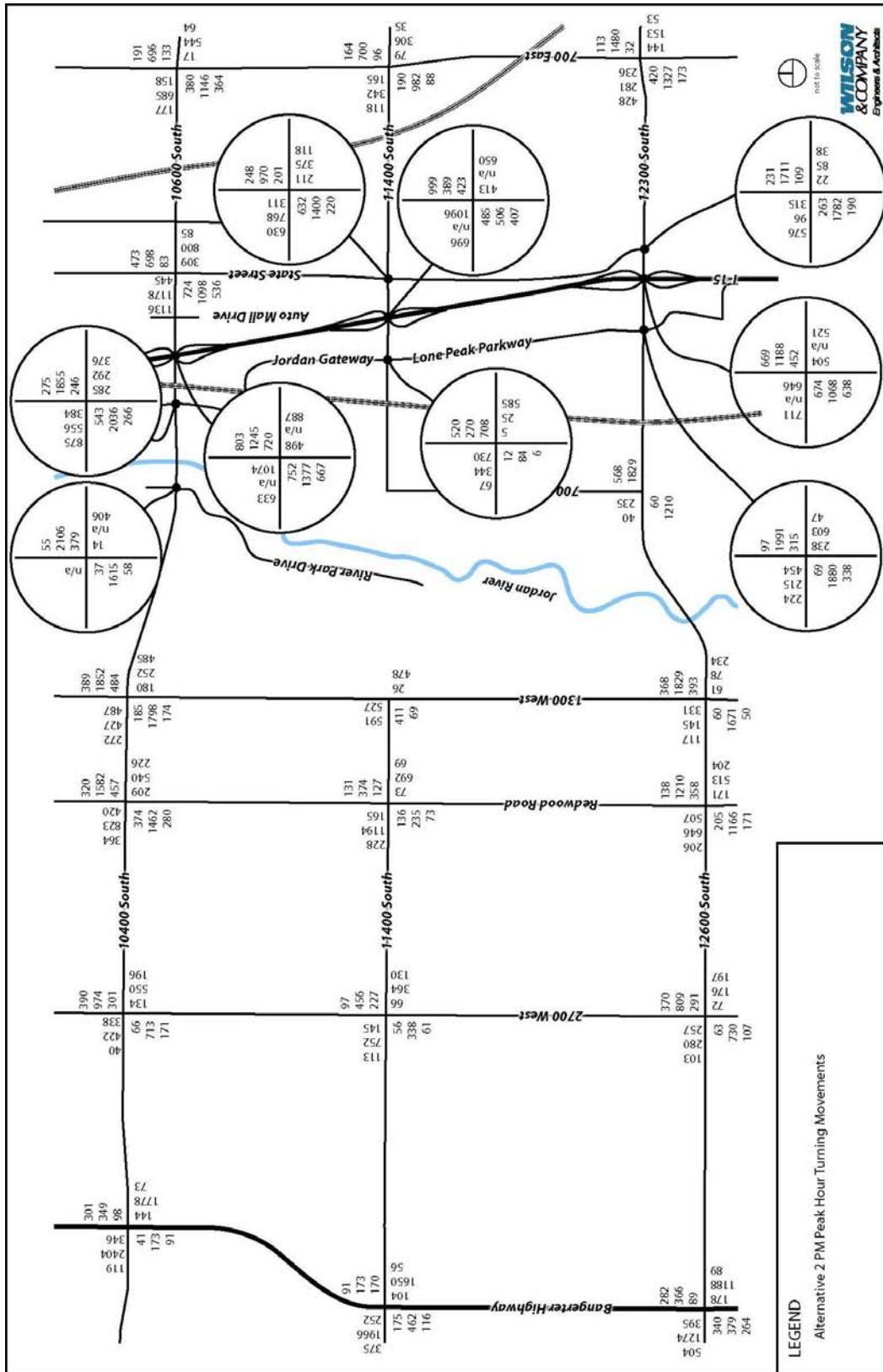


Figure 21. Alternative 3a PM Peak Hour Turning Movements

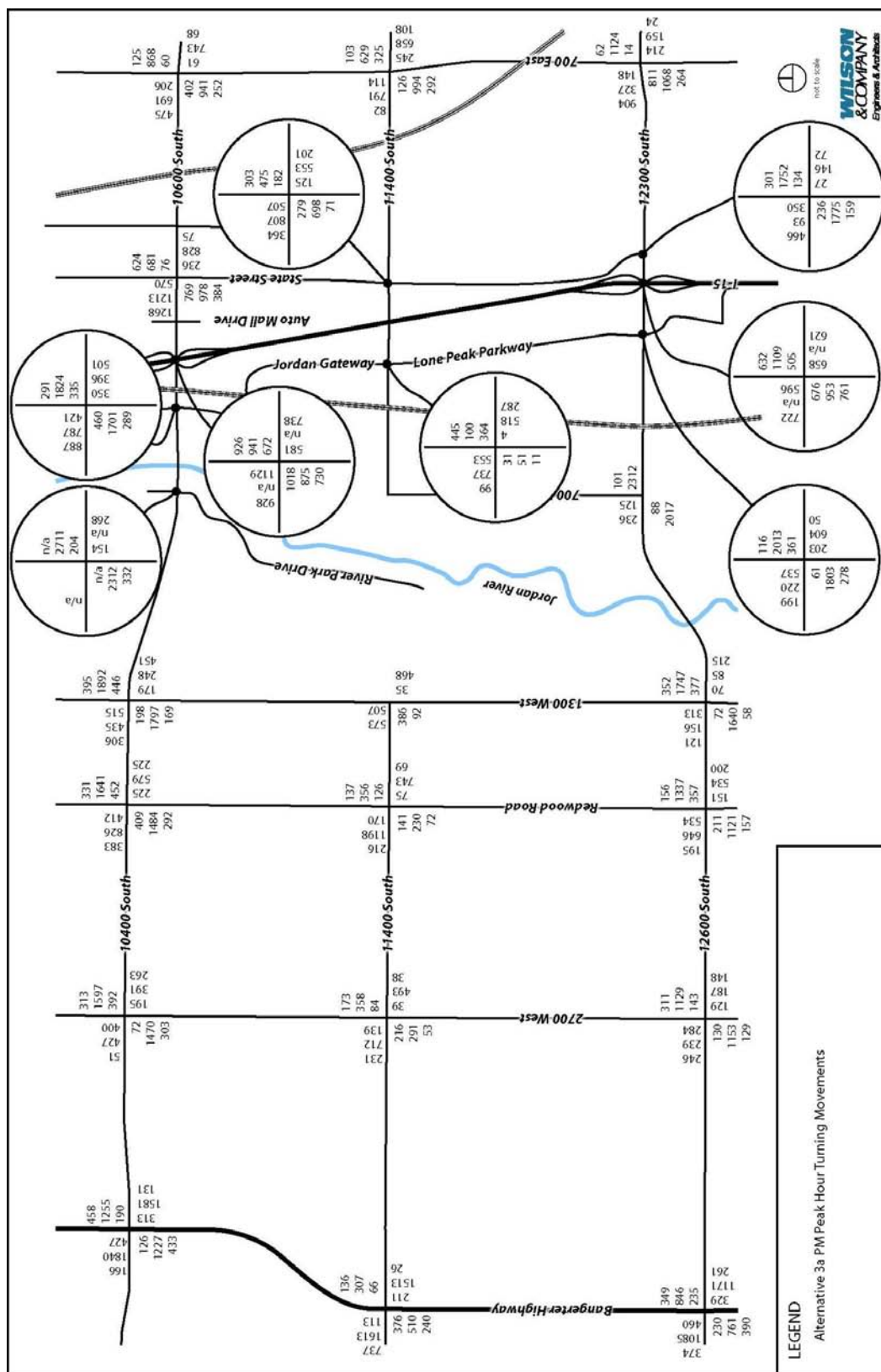


Figure 22. Alternative 3b PM Peak Hour Turning Movements

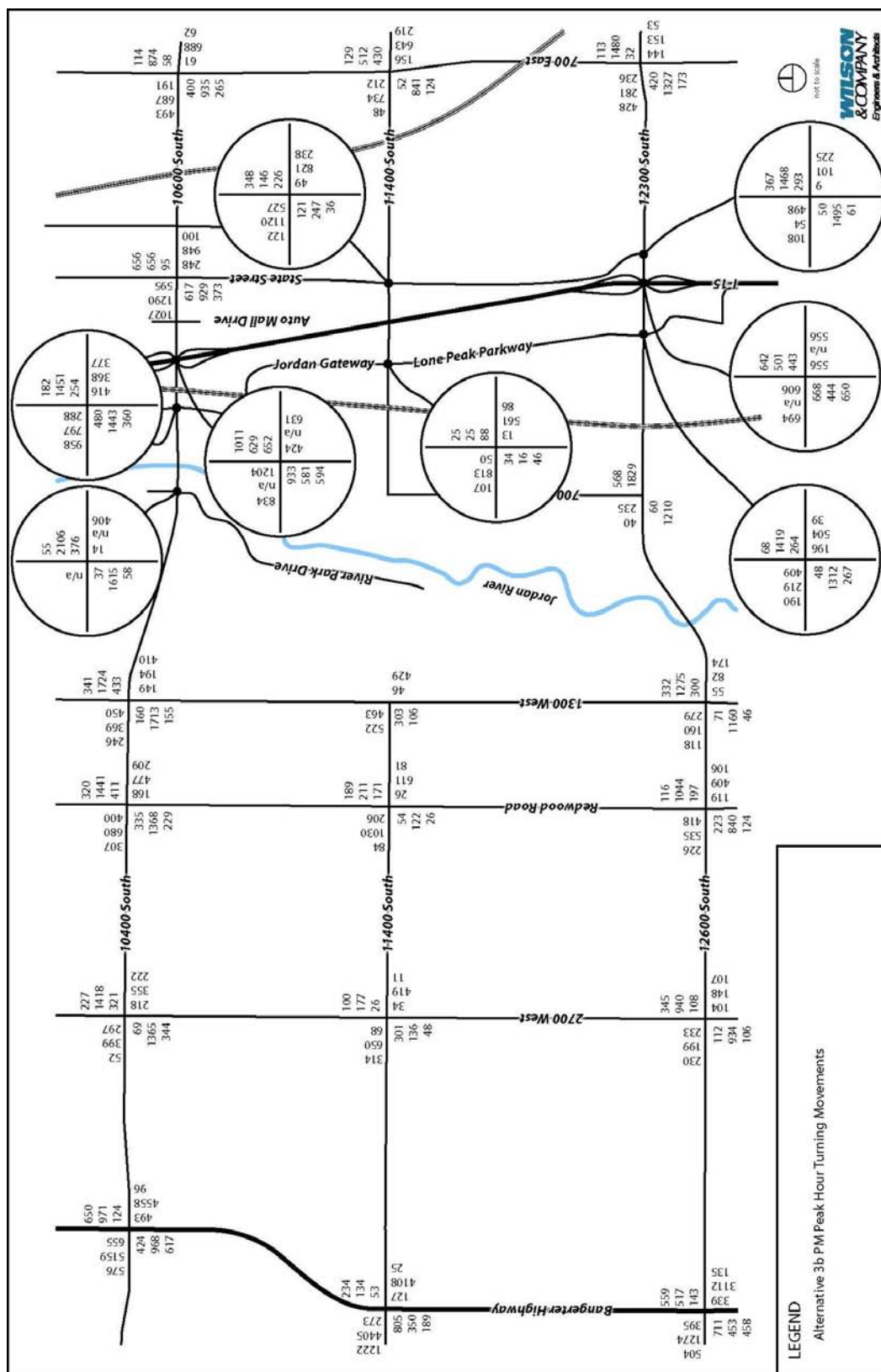
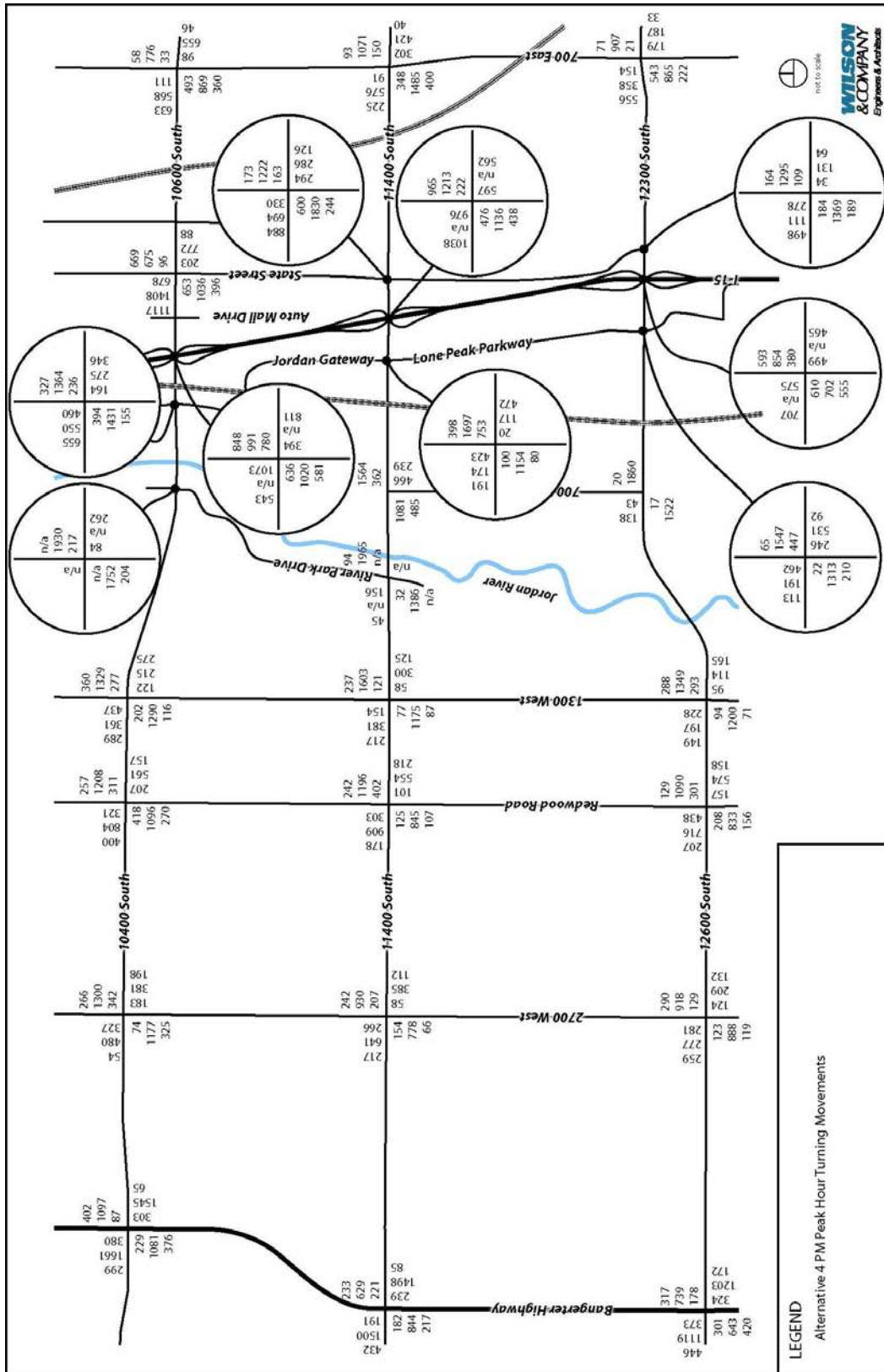


Figure 23. Alternative 4 PM Peak Hour Turning Movements



### Figure 24. Alternative 5 PM Peak Hour Turning Movements

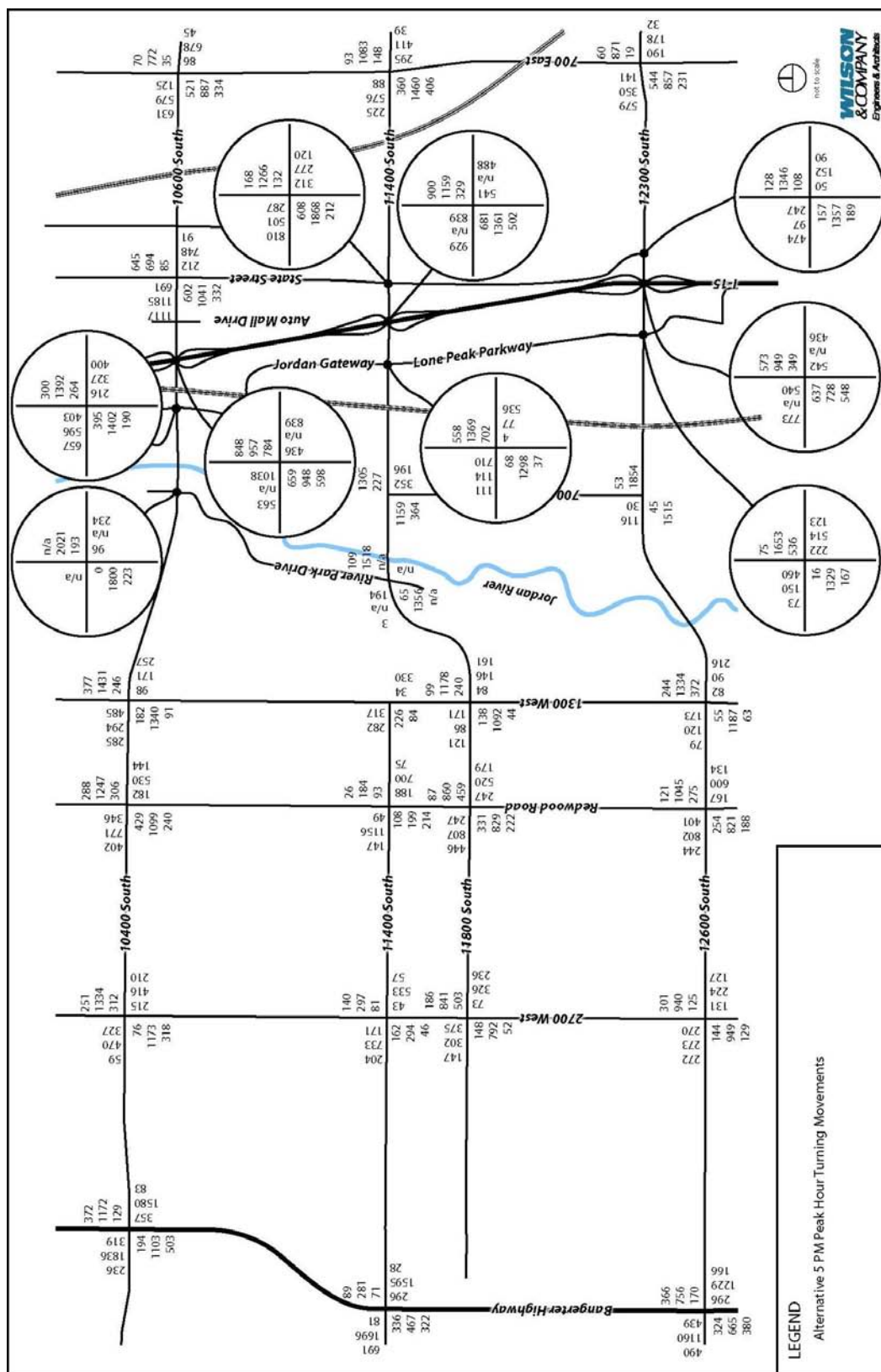
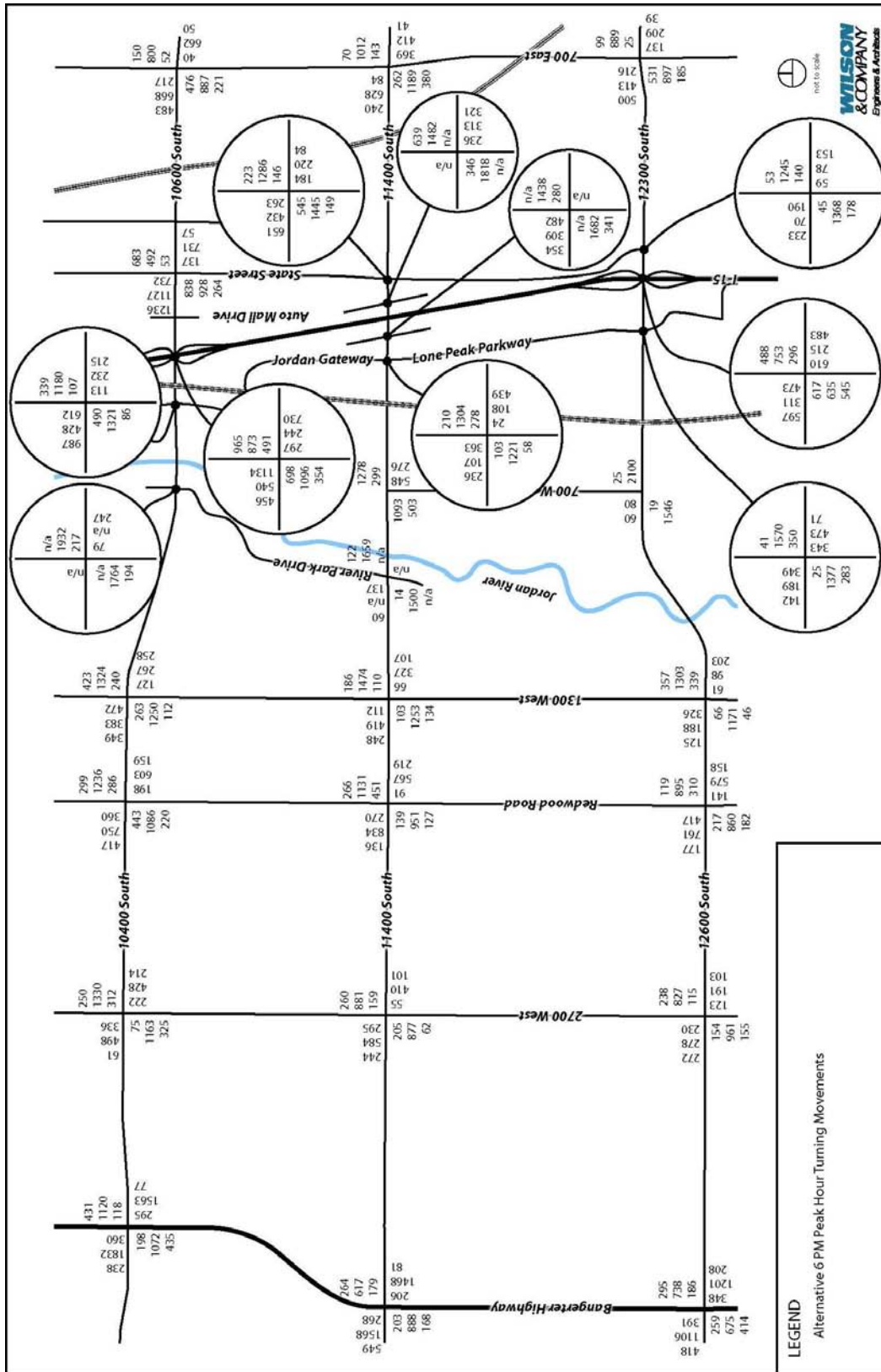


Figure 25. Alternative 6 PM Peak Hour Turning Movements



### Figure 26. Alternative 7 PM Peak Hour Turning Movements

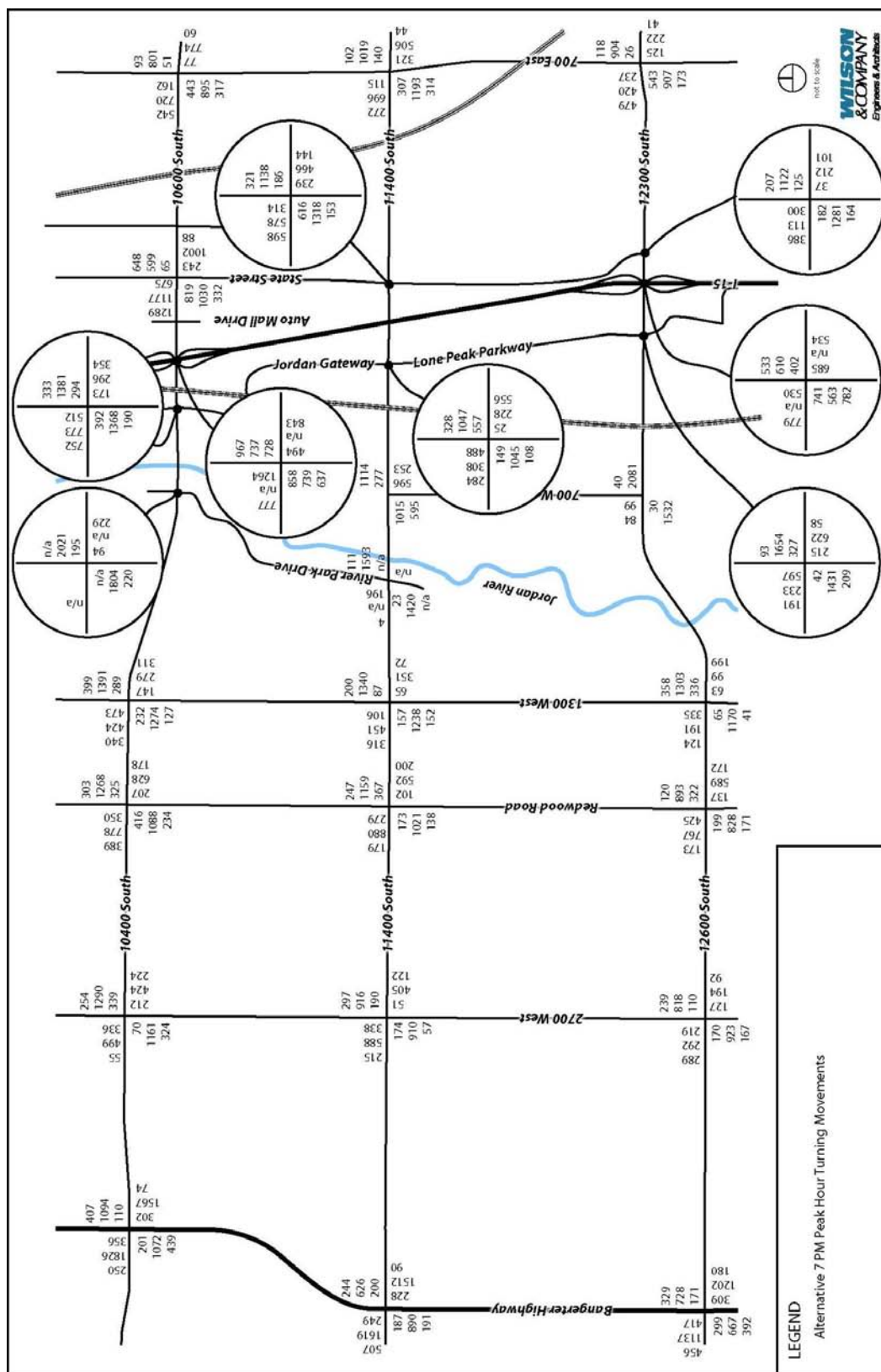
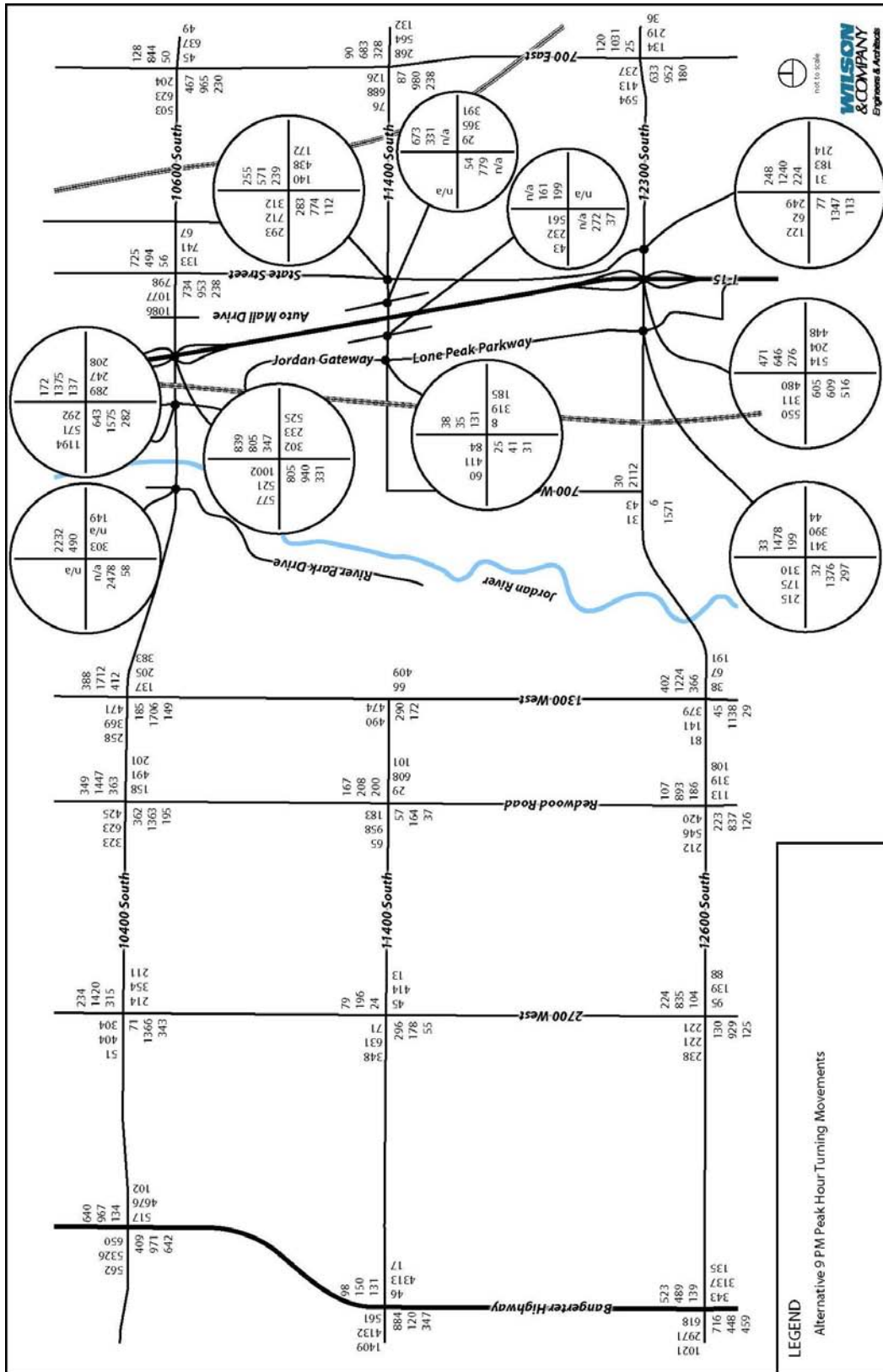


Figure 27. Alternative 9 PM Peak Hour Turning Movements



Technical Memorandum  
AM Peak Hour Operations Analysis  
11400 South EIS

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## AM Peak Hour Operations Analysis

The AM Peak Hour critical intersections analysis is similar to the PM analysis and includes those intersections most likely to be affected by changes as a result of the alternatives.

### I. Critical Intersection (SYNCHRO) Analysis

The critical intersection analysis uses the operations analysis software SYNCHRO for determining a level of service (LOS) from the Highway Capacity Manual. For each alternative and each critical intersection, the signal phasing was optimized and adjusted for the best LOS. For this analysis, a 150-second signal cycle was assumed. In addition to signal phasing adjustments, other geometric conditions (turn lane additions and reconfigurations) were changed or added as needed and appropriate for improving the intersection level of service. The laneage configuration for the alternatives in the secondary screening procedure may be found in the **Secondary Screening Procedure: Critical Intersection Laneage Report**.

The table below identifies intersections at or over capacity<sup>1</sup> (in red) based on the results of the AM peak hour critical intersection analysis.

**Table 1. AM Peak Hour Critical Intersection Level of Service**

Critical Intersection	Alternative				
	NB	1	3	4	7
10600 / Redwood					
10600 / 1300					
10600 / Jordan					
10600 / Auto Mall					
10600 / State					
11400 or 11800 / Redwood					
11400 Or 11800 / 1300					
11400 / Jordan					
11400 / State					
12300 / Redwood					
12300 / 1300					
12300 / Lone Peak					
12300 / State					
Intersections Under Capacity	9	12	13	13	13
Intersections At or Over Capacity	4	1	0	0	0

<sup>1</sup> At or over capacity is defined as a level of service E or F, respectively.

Interchange Area	Alternative				
	NB	1	3	4	7
10600 / I-15					
10600 / I-15 WB Weave					
11400 / I-15	n/a	n/a	n/a		n/a
12300 / I-15					

## II. Interstate (HCS) Analysis

The interstate operations analysis for the AM peak hour is similar to the PM peak hour analysis. The analysis uses the freeway systems module from the Highway Capacity Software to identify interstate segments that are at or over capacity<sup>2</sup>. The table below identifies the segments (basic freeway, on-ramp, off-ramp, and weave segments) that are at or over capacity for each alternative.

**Table 2. Southbound I-15 AM Peak Hour Level of Service**

	North of 10600 South	10600 South Off Ramp	10600 South On Ramp	10600 South to 11400 South	11400 South On Ramp	11400 South to 12300 South	12300 South Off Ramp	12300 South On Ramp	South of 12300 South
No Build					n/a				
Alternative 1					n/a				
Alternative 3a					n/a				
Alternative 4			Weave Section						
Alternative 7									

**Table 3. Northbound I-15 PM Peak Hour Level of Service**

<sup>2</sup> At or over capacity is defined as a level of service E or F, respectively.

	South of 12300 South	12300 South Off Ramp	12300 South On Ramp	12300 South to 11400 South	11400 South to 10600 South	10600 South Off Ramp	10600 South On Ramp	North of 10600 South
No Build								
Alternative 1								
Alternative 3a								
Alternative 4			Weave Section*		Weave Section			
Alternative 7								

Technical Memorandum  
PM Peak Hour Operation Analysis  
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Prepared by Wilson & Company  
Prepared for Utah Department of Transportation

## PM Peak Hour Operations Analysis

The initial screening procedure for the transportation element of the EIS included identifying the critical intersections and interstate segments in 2030 that would be at or over capacity.

The critical intersections in this analysis included those intersections most likely to be affected by changes as a result of the alternatives. The PM volume data was selected because it best represented the peak hour of the day for the project area.

### I. Critical Intersection (SYNCHRO) Analysis

The critical intersection analysis uses the operations analysis software SYNCHRO for determining a level of service (LOS) from the Highway Capacity Manual. For each alternative and each critical intersection, the signal phasing was optimized and adjusted for the best LOS. For this analysis, a 150-second signal cycle was assumed. In addition to signal phasing adjustments, other geometric conditions (turn lane additions and reconfigurations) were changed or added as needed along the major arterials for improving the intersection level of service. The laneage configuration for alternatives that pass the initial screening procedure may be found in the **Secondary Screening Procedure: Critical Intersection Laneage Report**.

The table below identifies intersections at or over capacity<sup>1</sup> (in red) based on the results of the PM peak hour critical intersection analysis.

**Table 1. PM Peak Hour Critical Intersection Level of Service**

Critical Intersection	Alternative										
	NB	1	2	3	3b	3c	4	5	6	7	9
10600 / Redwood											
10600 / 1300											
10600 / Jordan											
10600 / Auto Mall											
10600 / State											
11400 or 11800 / Redwood											
11400 Or 11800 / 1300											
11400 / Jordan											
11400 / State											
12300 / Redwood											
12300 / 1300											
12300 / Lone Peak											
12300 / State											
Intersections Under Capacity	7	9	3	8	11	8	10	10	10	8	9
Intersections At or Over Capacity	6	4	10	5	2	5	3	3	3	5	4

<sup>1</sup> At or over capacity is defined as a level of service E or F, respectively.

Interchange Area	Alternative										
	NB	1	2	3	3b	3c	4	5	6	7	9
10600 / I-15											
10600 / I-15 WB Weave											
11400 / I-15	n/a	n/a		n/a	n/a	n/a				n/a	
12300 / I-15											

## II. Interstate (HCS) Analysis

The interstate operations analysis used the freeway systems module from the Highway Capacity Software to identify interstate segments that are at or over capacity<sup>2</sup>. The table below identifies the segments (basic freeway, on-ramp, off-ramp, and weave segments) that are at or over capacity for each alternative.

**Table 2. Southbound I-15 PM Peak Hour Level of Service**

	North of 10600 South	10600 South Off Ramp	10600 South On Ramp	10600 South to 11400 South	11400 South On Ramp	11400 South to 12300 South	12300 South Off Ramp	12300 South On Ramp	South of 12300 South
No Build					n/a				
Alternative 1					n/a				
Alternative 2			Weave Section						
Alternative 3a					n/a				
Alternative 3b					n/a				
Alternative 4			Weave Section						
Alternative 5			Weave Section						
Alternative 6					n/a				
Alternative 7					n/a				
Alternative 9					n/a				

<sup>2</sup> At or over capacity is defined as a level of service E or F, respectively.

**Table 3. Northbound I-15 PM Peak Hour Level of Service**

	South of 12300 South	12300 South Off Ramp	12300 South On Ramp	12300 South to 11400 South	11400 South to 10600 South	10600 South Off Ramp	10600 South On Ramp	North of 10600 South
No Build								
Alternative 1								
Alternative 2			Weave Section		Weave Section			
Alternative 3a								
Alternative 3b								
Alternative 4			Weave Section		Weave Section			
Alternative 5			Weave Section		Weave Section			
Alternative 6								
Alternative 7								
Alternative 9								

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PM Travel Time Analysis  
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Addendum (9-2004)

Prepared by Wilson & Company

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## **Introduction**

The secondary screening level for the transportation element of the EIS included a travel time analysis, a phasing analysis, and a presentation of the AM peak hour analysis.

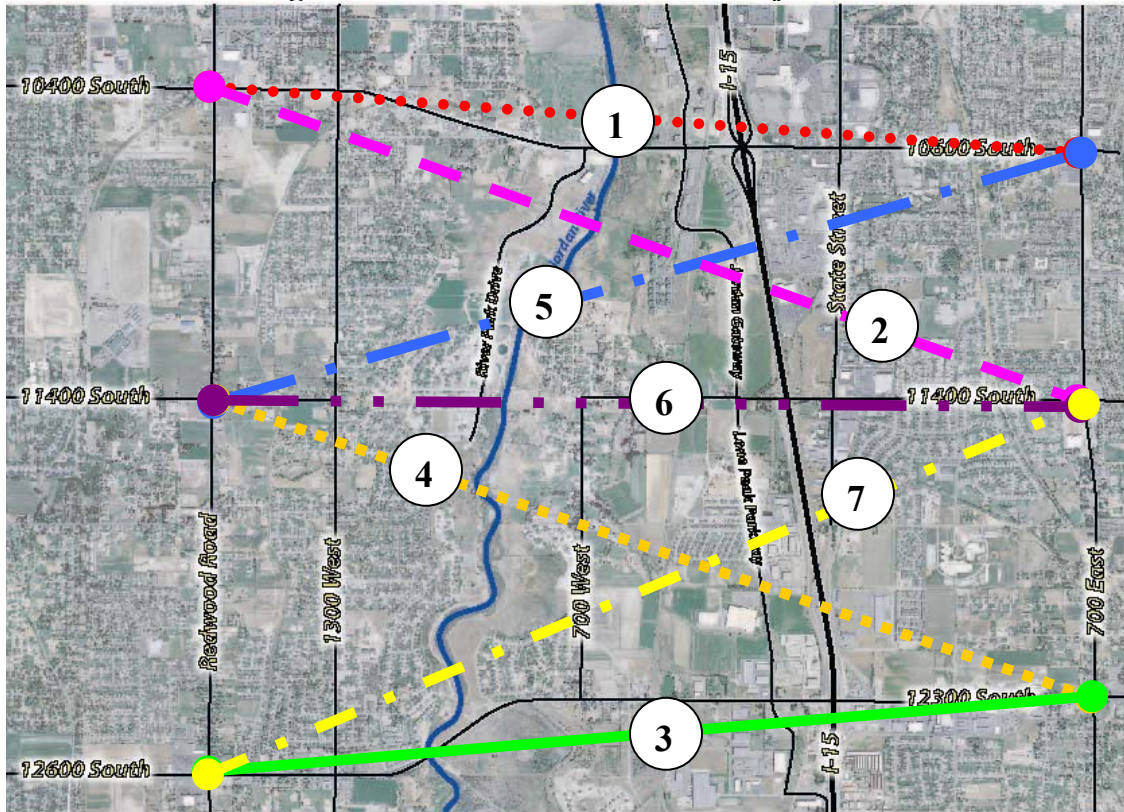
## **PM Travel Time Analysis (included Alternative 6)**

The travel time analysis was conducted at a very basic level for comparison of travel times within the project area. The SYNCHRO intersection analysis conducted for the PM peak hour also provided an arterial analysis for the project area. From the arterial analysis, average arterial speeds were calculated by SYNCHRO based on congestion and signal coordination. For each alternative the arterial network was optimized for level of service (LOS) and coordination.

Eleven origin and destination (O/D) pairs were selected for the travel time analysis. Seven were based on travel time across the project area and four were based on travel time to the interstate. The graphics below show the origin and destination pairs for the analysis.

A travel time ( $\text{distance} \div \text{average speed}$ ) was calculated for each O/D pair. For O/D pairs that could be connected by more than one route, the fastest travel time was used. The travel times were summed based on the two travel time schemes (1-across project area and 2-to interstate) and ranked according to the fastest average travel times for each alternative.

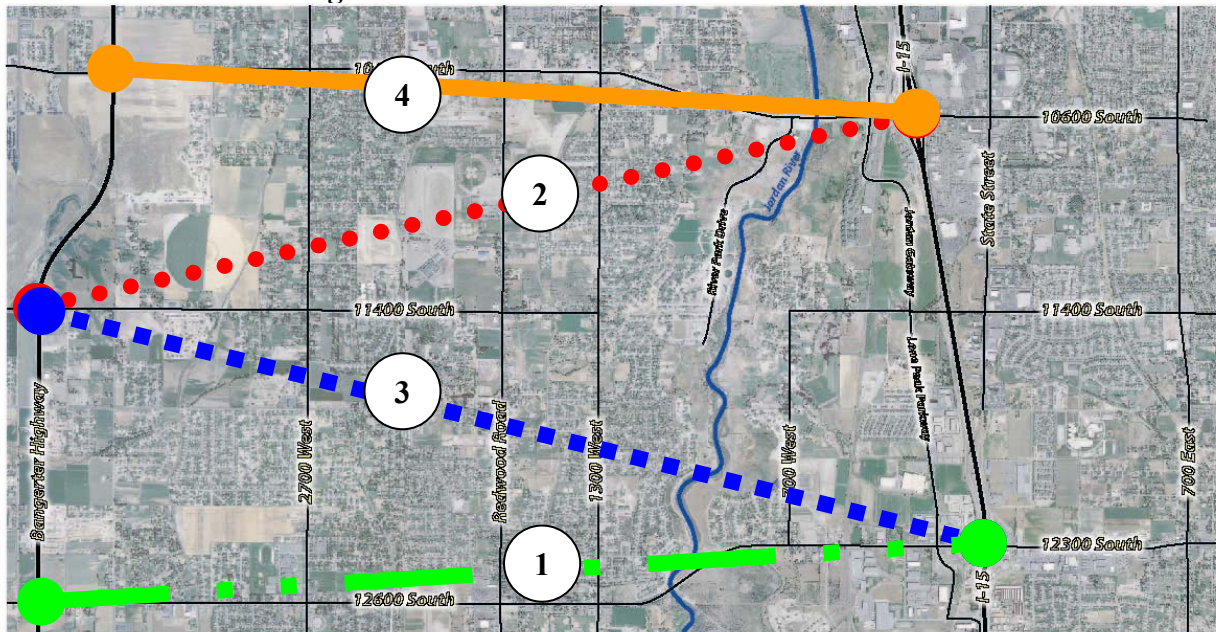
**Figure 1. Travel Scheme Across Project Area**



*Table 1. Total Travel Time Across Project Area*

Alternative	Total Travel Time	Rank
No Build	238 minutes	6
Alternative 1	170 minutes	2
Alternative 3a	171 minutes	3
Alternative 4	164 minutes	1
Alternative 6	202 minutes	5
Alternative 7	187 minutes	4

**Figure 2. Travel Scheme to Interstate**



*Table 2. Total Travel Time to Interstate*

Alternative	Total Travel Time	Rank
No Build	126 minutes	6
Alternative 1	114 minutes	3
Alternative 3a	105 minutes	2
Alternative 4	97 minutes	1
Alternative 6	116 minutes	4
Alternative 7	119 minutes	5

### Addendum (9-10-2004)

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## PM Travel Time Analysis including revised Preferred Alternative and Revised Alternative 7

This travel time analysis includes the revised Preferred Alternative for the EIS and the revised Alternative 7. The revisions eliminate the 6-lane section of 10600/10400 South from Redwood Road to River Park Drive.

The only routes affected are those that include 10600/10400 South from Redwood Road to River Park Drive. These routes are 1, 2, and 5 across the project area (Figure 1), and 2 and 4 between Bangerter Highway and I-15 (Figure 2). In fact, the only travel time affected is for Route 1 and Route 4 Figures 1 and 2, respectively. This is because the faster travel path is to use the river crossing (Routes 2 and 5; Route 2), thus by-passing the affected section of 10600/10400 South.

The end result for both the revised Preferred Alternative and revised Alternative 7 adds only one minute of travel time to the total travel time in each case.

*Table 3. Total Travel Time Across Project Area*

Alternative	Total Travel Time	Rank
No Build	238 minutes	8
Alternative 1	170 minutes	3
Alternative 3a	171 minutes	4
Alternative 4	164 minutes	1
Alternative 4 (rev)	165 minutes	2
Alternative 6	202 minutes	7
Alternative 7	187 minutes	5
Alternative 7 (rev)	188 minutes	6

*Table 4. Total Travel Time to Interstate*

Alternative	Total Travel Time	Rank
No Build	126 minutes	8
Alternative 1	114 minutes	4
Alternative 3a	105 minutes	3
Alternative 4	97 minutes	1
Alternative 4 (rev)	98 minutes	2
Alternative 6	116 minutes	5
Alternative 7	119 minutes	6
Alternative 7 (rev)	120 minutes	7

Technical Memorandum  
Secondary Screening Procedure: Critical Intersection Laneage  
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Prepared by Wilson & Company  
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## Introduction

In addition to signal phasing adjustments, other geometric conditions (turn lane additions and reconfigurations) were changed or added as needed along the major arterials for improving the intersection level of service at critical intersections. The laneage configuration for the critical intersections in alternatives that passed the initial screening are shown in the table below in comparison to the existing and No-Action conditions.

**Table 1. Critical Intersection Laneage**

Existing Intersection Laneage (No-Action Laneage)					General Intersection Improvements				
	SB	EB	NB	WB	Alt	SB	EB	NB	WB
10400/10600 South									
Redwood Road	L 2T R (L 2T R)	L 2T R (L 2T R)	L 2T R (L 2T R)	L 2T R (L 2T R)	1	L 2T R	2L 3T R	L 2T R	2L 3T R
					3	L 2T R	2L 3T R	L 2T R	2L 3T R
					4	L 2T R	2L 3T R	L 2T R	2L 3T R
					7	2L 2T R	2L 3T R	L 2T R	L 3T R
1300 West	L T R (L T R)	L 2T R (L 2T R)	L T R (L T R)	L 2T R (L 2T R)	1	L T R	L 3T R	L T R	L 3T R
					3	L T R	L 3T R	L T R	L 3T R
					4	L T R	L 3T R	L T R	L 3T R
					7	L T R	L 3T R	L T R	L 3T R
River Park Drive	L/T/R (L/T/R)	L 2T R (L 2T R)	L T R (L T R)	L 2T R (L 2T R)	1	L/R	L 3T R	L T R	L 3T R
					3	L/R	L 3T R	L T R	L 3T R
					4	L/R	L 3T R	L T R	L 3T R
					7	L/R	L 3T R	L T R	L 3T R
Jordan Gateway	L 2T R (L 2T R)	L 2T T/R (L 2T T/R)	L 2T R (L 2T R)	L 2T R (L 2T R)	1	2R 2T L	2L 3T R	L 2T R	2L 3T R
					3	2R 2T 2L	2L 3T R	2L 2T R	2L 3T R
					4	2R 2T 2L	2L 3T R	L 2T R	2L 3T R
					7	2R 3T 2L	2L 3T R	L 3T R	2L 3T R
I-15	2L R (2L R)	2L 3T R (2L 3T R)	2L 2R (2L 2R)	2L 3T R (2L 3T R)	1	3L R	2L 3T R	2L 2R	2L 3T R
					3	3L R	2L 3T R	2L 2R	2L 3T R
					4	3L R	2L 3T R	2L 2R	2L 3T R
					7	3L R	2L 3T R	2L 2R	2L 3T R
Auto Mall Drive	2L T R (2L T R)	2L 2T T/R (2L 2T T/R)	2L T R (2L T R)	2L 2T T/R (2L 2T T/R)	1	2L T R	2L 2T T/R	2L T R	2L 2T T/R
					3	2L T R	2L 2T T/R	2L T R	2L 2T T/R
					4	2L T R	2L 2T T/R	2L T R	2L 2T T/R
					7	2L T R	2L 2T T/R	2L T R	2L 2T T/R
State Street	L 3T R (L 3T R)	2L 2T R (2L 2T R)	L 2T R (L 3T R)	2L 2T R (2L 2T R)	1	2R 3T 2L	2L 2T R	2L 3T R	2L 2T R
					3	2R 3T 2L	2L 2T R	2L 3T R	2L 2T R
					4	2R 3T 2L	2L 2T R	2L 3T R	2L 2T R
					7	2R 3T 2L	2L 2T R	2L 3T R	2L 2T R
11400 South									
Redwood Road	L 2T R (L 2T R)	L T R (L T R)	L 2T R (L 2T R)	L T/R (L T/R)	1	2L 2T R	L 2T R	L 2T R	2L 2T R
					3	L 2T R	L T R	L 2T R	L T R
					4	2L 2T R	L 2T R	L 2T R	2L 2T R
					7	L 2T R	L 2T R	L 2T R	L 2T R
1300 West	T/R (T/R)	L/R (L/R)	L/T (L/T)	-	1	L T R	L 2T R	L T R	L 2T R
					3	T R	L R	L T	-
					4	L T R	L 2T R	L T R	L 2T R
					7	L T R	L 2T R	L T R	L 2T R
River Park Drive	-	-	-	-	1	L T R	L 2T R	L T R	L 2T R
					3	-	-	-	-
					4	L T R	L 2T R	L T R	L 2T R
					7	L T R	L 2T R	L T R	L 2T R
700 West	-	T/R (T/R)	L/R (L/R)	L/T (L/T)	1	L/T/R	L 2T R	L T R	L 2T R
					3	L/T/R	L 2T R	L T R	L 2T R

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					4 7	L/T/R L/T/R	L 2T R L 2T R	L T R L T R	L 2T R L 2T R
Existing Intersection Laneage (No-Action Laneage)					General Intersection Improvements				
	SB	EB	NB	WB	Alt	SB	EB	NB	WB
Jordan Gateway/Lone Peak Parkway	R T/L (L 2T R)	L/T/R (L T/R)	L T R (L 2T R)	L/T/R (L T/R)	1 3 4 7	L 2T R 2L 3T R 2L 2T R 2L 2T R	L 2T R L T R L 2T R L 2T R	L 2T R L 3T R L 2T R L 2T R	L 2T R 2L T R 2L 2T R 2L 2T R
I-15	-	T (2T)	-	T (2T)	1 3 4 7	- - 2L R -	2T 2T 2L 2T R 2T	- - 2L R -	2T 2T 2L 2T R 2T
State Street	L T T/R (2L 2T R)	L T/R (L T T/R)	L T T/R (L 2T R)	L T R (2L 2T R)	1 3 4 7	2L 3T R 2L 2T R 2L 2T R 2L 2T R	2L 2T R L 2T R 2L 2T R 2L 2T R	L 3T R L 3T R L 3T R 2L 3T R	2L 2T R 2L 2T R 2L 2T R 2L 2T R
12300/12600 South									
Redwood Road	L T R (L 2T R)	L 2T R (L 2T R)	L T R (L 2T R)	L 2T R (L 2T R)	1 3 4 7	2L 2T R 2L 2T R 2L 2T R 2L 2T R	L 3T R 2L 3T R L 2T R L 2T R	L 2T R L 2T R L 2T R L 2T R	L 3T R 2L 3T R L 2T R 2L 2T R
1300 West	L T R (L T R)	L 2T R (L 2T R)	L T/R (L T R)	L 2T R (L 2T R)	1 3 4 7	L T R L T R L T R L T R	L 3T R L 3T R L 2T R L 2T R	L T/R L T/R L T/R L T/R	L 3T R L 3T R L 2T R L 2T R
700 West	L/R (L/R)	L/T T (L/T T)	-	T T/R (T T/R)	1 3 4 7	L/R L/R L/R L/R	L 3T L 3T L 2T L 2T	- - - -	3T R 3T R 2T R 2T R
Lone Peak Parkway	2L T R (2L T R)	L T T/R (L T T/R)	2L T T/R (2L T T/R)	L 2T R (L 2T R)	1 3 4 7	2L T R 2L T R 2L T R 2L 2T R	L 3T R L 3T R L 2T R L 2T R	2L 2T R 2L 2T R 2L 2T R 2L T T/R	L 3T R L 3T R 2L 2T R 2L 2T R
I-15	2L R (2L R)	2L 2T R (2L 2T R)	L R (L R)	2L 2T R (2L 2T R)	1 3 4 7	2L R 2L R 2L R 2L R	2L 2T R 2L 2T R 2L 2T R 2L 2T R	L R L R L R L R	2L 2T R 2L 2T R 2L 2T R 2L 2T R
State Street	L 2T R (L 2T R)	L 2T R (L 2T R)	L T T/R (L T T/R)	L T T/R (L T T/R)	1 3 4 7	L 2T R L 2T R L 2T R L 2T R	L 3T R L 3T R L 2T R L 2T R	L 2T R L 2T R L 2T R L T T/R	L 3T R L 3T R L 2T R L 2T R

From: Stephen G. Pouliot, PE

To: Mary Deloretto, URS

Date: 21 October, 2004

Copies To: Mike Falini

File No.: Wilson & Company  
X3-310-010

Subject: 11400 South EIS – Sequencing Analysis Methodology

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## Sequencing Analysis Methodology

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The Sequencing Analysis uses a methodology that treats each alternative (Alternative 1, 3, 4, and 7) independently with two sequencing scenarios each. Each alternative starts with a baseline of No-Action with components unique to each alternative added at 2012, 2022, or 2030 until the volume to capacity ratio (at the Jordan River screenline) is brought under 1.10. The analysis does not seek to maximize the sequencing, but report the affect of sequencing options on east-west mobility.

The alternatives evaluated in this analysis are shown below and summarized in Table 1.

### Alternative 1

The sequencing analysis for Alternative 1 included the following logical sequencing options:

#### SCENARIO A

- a) widen 10400/10600 South first,
- b) 11400 South river crossing second,
- c) widen 12300/12600 South and add remaining components third.

#### SCENARIO B

- a) 11400 South river crossing first,
- b) widen 10400/10600 South second,
- c) widen 12300/12600 South and remaining components third.

### Alternative 3A

The sequencing analysis for Alternative 3A included the following logical sequencing options:

#### SCENARIO A

- a) widen 10400/10600 South first,
- b) widen 12300/12600 South second,
- c) widen Jordan Gateway/Lone Peak Parkway third.

#### SCENARIO B

- a) widen 12300/12600 South first,
- b) widen 10400/10600 South second,
- c) widen Jordan Gateway/Lone Peak Parkway third.

**Alternative 4**

The sequencing analysis for Alternative 4 included the following logical sequencing options:

**SCENARIO A**

- a) 11400 South river crossing first,
- b) I-15 interchange second, and
- c) widen 10600 South third.

**SCENARIO B**

- a) I-15 interchange first,
- b) 11400 South river crossing second, and
- c) widen 10600 South to Redwood Road third.

**Alternative 7**

The sequencing analysis for Alternative 7 included the following logical sequencing options:

**SCENARIO A**

- a) 11400 South river crossing first,
- b) widen Jordan Gateway/Lone Peak Parkway second,
- c) widen 10600 South to Redwood Road third.

**SCENARIO B**

- a) 11400 South river crossing first,
- b) widen 10600 South to Redwood Road second,
- c) widen Jordan Gateway/Lone Peak Parkway third.

**Table 1. Sequencing Scenarios Matrix**

① - Phase Number

	Alternative 1		Alternative 3		Alternative 4		Alternative 7	
	Scenario A	Scenario B	Scenario A	Scenario B	Scenario A	Scenario B	Scenario A	Scenario B
<i>A – Widen 10600 from I-15 to Bangerter</i>	①	②	①	②				
<i>B – River Crossing</i>	②	①			①	②	①	①
<i>C- Widen 12300 From I-15 to Bangerter</i>	③	③	②	①				
<i>D – Widen Jordan Gateway</i>			③	③			②	③
<i>E – Widen 10600 from I-15 to Redwood</i>					③	③	③	②
<i>F – I-15 Interchange</i>					②	①		

## **Models for Analysis**

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Existing 2030 models run for the operations analysis were used for the final (2030) phase analysis of each alternative. These 2030 models are labeled using upper case values.

- (A) 2030 Alternative 1
- (B) 2030 Alternative 3
- (C) 2030 Alternative 4
- (D) 2030 Alternative 7

Models for 2012 and 2022 were run to begin filling the modeling requirement matrix shown in Table 2. After review of initial results, additional models were run to complete Table 2. The models for 2012 and 2022 are labeled using lower case values (*all models created for the sequencing analysis are listed, however not all models were used in this analysis*).

Table 3 shows how a unique model run matches with the sequencing analysis for each alternative.

### **2012 Models**

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- a) Run 2012 No Action model – the 2012 No Action Alternative in the Long Range Plan without 11400 South improvements.
- b) Run 2012 model with 11400 South river crossing – the No Action Alternative plus extend 11400 South as a five-lane section from I-15 to 1300 West (river crossing).
- c) Run 2012 model with 11400 South river crossing plus 11400 South widening – the No Action Alternative plus extend 11400 South as a five-lane section from 700 West to 1300 West (river crossing), widen 11400 South to five-lane section between I-15 to Bangerter, and modify intersection at 11400 South and Bangerter.
- d) Run 2012 model with 11400 South interchange – the No Action Alternative plus add an interchange (SPUI) at 11400 South and I-15 (five-lane section).
- e) Run 2012 model with 10600 South widening to Redwood Road – the No Action Alternative plus widen 10600 South to six lanes from Jordan Gateway to just west of Redwood Road.
- f) Run 2012 model with 10600 South and 12300 South widening – the No Action Alternative plus widen 10600 South and 12300 South to six lanes to Bangerter Highway.
- g) Run 2012 model with 10600 South widening to Bangerter – the No Action Alternative plus widen 10600 South to six lanes from Jordan Gateway to Bangerter Highway.

### **2022 Models**

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- h) Run 2022 model with the river crossing as a No Action baseline.
- i) Run 2022 model with the river crossing in conjunction with widening 11400 South to four lanes from 1300 West to Bangerter Highway.
- j) Run 2022 model with the river crossing in conjunction with adding the I-15 interchange (SPUI) at 11400 South and I-15 (5 lane section).
- k) Run 2022 model with river crossing in conjunction with widening 10600 South to six lanes from Jordan Gateway to just west of Redwood Road.
- l) Run 2022 model with river crossing in conjunction with widening 10600 South and 12300 South to six lanes to Bangerter Highway.
- m) Run 2022 model with river crossing in conjunction with widening 10600 South to Bangerter Highway.

**Additional Models**

**2012 Models**

- n) Run 2012 model with 10600 South widened to six lanes from Bangerter to I-15 and a four-lane river crossing on 11400 South.
- o) Run 2012 model with 12300 South widened to six lanes from Bangerter to I-15.
- p) Run 2012 model with a four-lane river crossing on 11400 South and an I-15 interchange at 11400 South.
- q) Run 2012 model with a four-lane river crossing on 11400 South and widen Jordan Gateway to six lanes from 10600 South to 12300 South.

**2022 Models**

- r) Run 2022 model with 10600 South widened to six lanes from Bangerter to I-15, plus widen 12300 South to six lanes from Bangerter to I-15 and widen Jordan Gateway to six lanes from 10600 South to 12300 South.
- s) Run 2022 model with a four-lane river crossing on 11400 South, plus an I-15 Interchange at 11400 South and widen 10600 South to six lanes from Redwood Road to I-15.

**Table 2. Models Runs Matrix**

✓ - Model Complete

	Alternative 1		Alternative 3		Alternative 4		Alternative 7	
	Scenario A	Scenario B	Scenario A	Scenario B	Scenario A	Scenario B	Scenario A	Scenario B
<i>Widen 10600 from I-15 to Bangerter</i>	✓ -2012①	✓ -2022②	✓ -2012①	✓ -2012②				
<i>River Crossing</i>	✓ -2012②	✓ -2012①			✓ -2012①	✓ -2012②	✓ -2012①	✓ -2012①
<i>Widen 12300 From I-15 to Bangerter</i>	✓ -2022③ ✓ -2030③	✓ -2022③ ✓ -2030③	✓ -2012②	✓ -2012①				
<i>Widen Jordan Gateway</i>			✓ -2022③ ✓ -2030③	✓ -2022③ ✓ -2030③			✓ -2012②	✓ -2030③
<i>Widen 10600 from I-15 to Redwood</i>					✓ -2022③ ✓ -2030④	✓ -2022③ ✓ -2030④	✓ -2030③	✓ -2022②
<i>I-15 Interchange</i>					✓ -2022②	✓ -2012①		

**Table 3. Models Runs Identification Matrix**

(g) – Model ID; ① - Phase Number

	Alternative 1		Alternative 3		Alternative 4		Alternative 7	
	Scenario A	Scenario B	Scenario A	Scenario B	Scenario A	Scenario B	Scenario A	Scenario B
<i>Widen 10600 from I-15 to Bangerter</i>	(g) ①	(m) ②	(g) ①	(f) ②				
<i>River Crossing</i>	(n) ②	(b) ①			(b) ①	(p) ②	(b) ①	(b) ①
<i>Widen 12300 From I-15 to Bangerter</i>	(m) ③ (A) ③	(l) ③ (A) ③	(f) ②	(o) ①				
<i>Widen Jordan Gateway</i>			(r) ③ (B) ③	(r) ③ (B) ③			(q) ②	(D) ③
<i>Widen 10600 from I-15 to Redwood</i>					(s) ③ (C) ③	(s) ③ (C) ③	(D) ③	(k) ②
<i>I-15 Interchange</i>					(j) ②	(d) ①		

## Results of the Analysis

Comparing the volume-to-capacity (v/c ratio) across the Jordan River Screenline (see Tables 4a, 4b, and 4c) for each model shows how the various improvements affect the east-west network. The data from the screenline analysis is summarized in Tables 5, 6, 7, and 8 for Alternatives 1, 3, 4, and 7, respectively.

**Table 4a. Initial 2012 Models**

<b>INITIAL 2012 MODELS</b>	<b>Total</b>	<b>10600 South</b>	<b>11400 South</b>	<b>12300 South</b>
<i>(a) – No-Action 2012</i>				
2-way volume	91,000	47,000	0	44,000
Capacity	69,000	34,500	0	34,500
v/c	1.32	1.36	0.00	1.28
<i>(b) – 2012 River Crossing</i>				
2-way volume	104,000	40,000	24,000	40,000
Capacity	103,500	34,500	34,500	34,500
v/c	1.00	1.16	0.70	1.16
<i>(c) – 2012 River Crossing with 11400 South Widened to Bangerter Highway</i>				
2-way volume	104,000	40,000	26,000	38,000
Capacity	103,500	34,500	34,500	34,500
v/c	1.00	1.16	0.75	1.10
<i>(d) – 2012 Interchange at 11400 South</i>				
2-way volume	93,000	48,000	0	45,000
Capacity	69,000	34,500	0	34,500
v/c	1.35	1.39	0.00	1.30
<i>(e) – 2012 Widen 10600 South to Redwood Road</i>				
2-way volume	99,000	55,000	0	44,000
Capacity	86,300	51,800	0	34,500
v/c	1.15	1.06	0.00	1.28
<i>(f) – 2012 Widen 10600 South and 12300 South to Bangerter Highway</i>				
2-way volume	103,000	54,000	0	49,000
Capacity	103,600	51,800	0	51,800
v/c	0.99	1.04	0.00	0.95
<i>(g) – 2012 Widen 10600 South to Bangerter Highway</i>				
2-way volume	99,000	55,000	0	44,000
Capacity	86,300	51,800	0	34,500
v/c	1.15	1.06	0.00	1.28

**Table 4b. Initial 2022 Models**

<b>INITIAL 2022 MODELS</b>	<b>Total</b>	<b>10600 South</b>	<b>11400 South</b>	<b>12300 South</b>
<i>(h) – 2022 River Crossing</i>				
<i>2-way volume</i>	113,000	45,000	30,000	43,000
<i>Capacity</i>	103,500	34,500	34,500	34,500
<i>v/c</i>	1.09	1.30	0.87	1.10
<i>(i) – 2022 River Crossing with 11400 South Widened to Bangerter Highway</i>				
<i>2-way volume</i>	114,000	45,000	32,000	37,000
<i>Capacity</i>	103,500	34,500	34,500	34,500
<i>v/c</i>	1.10	1.30	0.93	1.07
<i>(j) – 2022 River Crossing with Interchange at 11400 South</i>				
<i>2-way volume</i>	114,000	44,000	33,000	37,000
<i>Capacity</i>	103,500	34,500	34,500	34,500
<i>v/c</i>	1.10	1.28	0.96	1.07
<i>(k) – 2022 River Crossing with 10600 South Widened to Redwood Road</i>				
<i>2-way volume</i>	117,000	52,000	28,000	37,000
<i>Capacity</i>	120,800	51,800	34,500	34,500
<i>v/c</i>	0.97	1.00	0.81	1.07
<i>(l) – 2022 River Crossing with 10600 South and 12300 South Widened to Bangerter Highway</i>				
<i>2-way volume</i>	123,000	53,000	27,000	43,000
<i>Capacity</i>	138,100	51,800	34,500	51,800
<i>v/c</i>	0.89	1.02	0.78	0.83
<i>(m) – 2022 River Crossing with 10600 South Widened to Bangerter Highway</i>				
<i>2-way volume</i>	119,000	53,000	28,000	38,000
<i>Capacity</i>	120,800	51,800	34,500	34,500
<i>v/c</i>	0.99	1.02	0.81	1.10

**Table 4c. Additional 2012 and 2022 Models**

<b>ADDITIONAL 2012 AND 2022 MODELS</b>	<b>Total</b>	<b>10600 South</b>	<b>11400 South</b>	<b>12300 South</b>
<i>(n) – 2012 River Crossing with 10600 South Widened to Bangerter Highway</i>				
2-way volume	106,000	45,000	21,000	40,000
Capacity	120,800	51,800	34,500	34,500
v/c	0.88	0.87	0.61	1.16
<i>(o) – 2012 Widen 12300 South to Bangerter Highway</i>				
2-way volume	98,000	47,000	0	51,000
Capacity	86,301	34,500	0	51,800
v/c	1.14	1.36	0	0.98
<i>(p) – 2012 River Crossing with Interchange at 11400 South</i>				
2-way volume	103,000	39,000	25,000	39,000
Capacity	103,500	34,500	34,500	34,500
v/c	1.00	1.13	0.72	1.13
<i>(q) – 2012 River Crossing with Widening on Jordan Gateway</i>				
2-way volume	101,000	40,000	22,000	39,000
Capacity	103,500	34,500	34,500	34,500
v/c	0.98	1.16	0.64	1.13
<i>(r) – 2022 Widen 10600 South and 12300 South to Bangerter Highway with Widening on Jordan Gateway</i>				
2-way volume	111,000	62,000	0	49,000
Capacity	103,601	51,800	0	51,800
v/c	1.07	1.20	0	0.95
<i>(s) – 2022 River Crossing with Interchange at 11400 South and Widen 10600 South to Redwood Road</i>				
2-way volume	117,000	52,000	27,000	38,000
Capacity	120,800	51,800	34,500	34,500
v/c	0.97	1.00	0.78	1.10

**Table 5. Sequencing Analysis of Alternative 1**

	2012		2022		2030	
<b>Alternative 1 Sequencing Scenario A</b>	Widen 10600 to Bangerter	River Crossing	N/A		Widen 123 to Bangerter	
Capacity Result	1.15 (g)	0.88 (n)	0.99 (m)		0.99 (A)	
	2012		2022		2030	
<b>Alternative 1 Sequencing Scenario B</b>	River Crossing		Widen 10600 to Bangerter		Widen 123 to Bangerter	
Capacity Result	1.00 (b)		0.99 (m)		0.99 (A)	

**Table 6. Sequencing Analysis of Alternative 3**

	2012		2022		2030	
<b>Alternative 3 Sequencing Scenario A</b>	Widen 10600 to Bangerter	Widen 123 to Bangerter	Widen Jordan Gateway		N/A	
Capacity Result	1.15 (g)	1.00 (f)	1.07 (r)		1.17 (B)	
	2012		2022		2030	
<b>Alternative 3 Sequencing Scenario B</b>	Widen 123 to Bangerter	Widen 10600 to Bangerter	Widen Jordan Gateway		N/A	
Capacity Result	1.14 (o)	1.00 (f)	1.07 (r)		1.17 (B)	

**Table 7. Sequencing Analysis of Alternative 4**

	2012		2022		2030	
<b>Alternative 4 Sequencing Scenario A</b>	River Crossing		I-15 Interchange	Widen 106 to Redwood	N/A	
Capacity Result	1.00 (b)		1.10 (j)	0.97 (s)	1.04 (C)	
	2012		2022		2030	
<b>Alternative 4 Sequencing Scenario B</b>	I-15 Interchange	River Crossing	Widen 106 to Redwood		N/A	
Capacity Result	1.35 (d)	1.00 (p)	0.97 (s)		1.04 (C)	

**Table 8. Sequencing Analysis of Alternative 7**

	2012		2022		2030	
<b>Alternative 7 Sequencing Scenario A</b>	River Crossing		Widen Jordan Gateway		Widen 106 to Redwood	
Capacity Result	1.00 (b)		1.00 (k)		1.03 (D)	
	2012		2022		2030	
<b>Alternative 7 Sequencing Scenario B</b>	River Crossing		Widen 106 to Redwood		Widen Jordan Gateway	
Capacity Result	1.00 (b)		1.00 (q)		1.03 (D)	